CEARC Canadian Environmental Assessment Research Council

CCREE Conseil canadien de la recherche sur l'évaluation environnementale

A FRAMEWORK FOR EFFECTIVE MONITORING

Natalia M. Krawetz, William R. MacDonald and Peter Nichols

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FOR EFFECTIVE MONITORING

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FOREWORD

The Canadian Environmental Assessment Research Council (CEARC) was established on January 30, 1984 by the federal Minister of the Environment to advise government, industry and universities on ways to improve the scientific, technical and procedural basis for environmental impact assessment (EIA) in Canada.

CEARC has established research activities related to improving the practice of environmental assessment. The Council has identified social impact assessment as one of several areas of interest for research. The Council's research programme in this area is outlined in its publication *Social Impact Assessment: A Research Prospectus*, which identifies improvement of monitoring and management capabilities as a priority activity. The present report was commissioned to advance the themes noted as requiring particular attention.

The purpose of CEARC-sponsored background documents is to provide relevant information and to stimulate discussion on the topics of interest to the EIA community. The opinions expressed, however, are strictly the authors' own and do not necessarily reflect the views of the members of the Council or its Secretariat.

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EXECUTIVE SUMMARY

This report develops an analytical framework for evaluating the rationale, requirements and responsibilities for pre- and post-decision monitoring programs that can be widely applied to evaluate the effectiveness of approaches to social impact assessment (SIA) monitoring. We believe that the premises of this framework can serve as a checklist with which to develop monitoring programs and test them for gaps and weaknesses.

The framework is based on a review of the literature, extensive consultation with various stakeholders, and verification using three case studies. To crystallize this framework, we have gone beyond the normal confines of the Canadian SIA literature, to include other SIA material as well as literature on environmental impact assessment, knowledge use, management and organizational development, interdisciplinarity, and program evaluation. We have discussed SIA monitoring with a number of practitioners in the SIA and environmental impact assessment fields, as well as with decision makers, community members, academics, proponents and representatives of government agencies. The points of view we express in this report are the result of our discussion and research over the past seven years.

THE FRAMEWORK

The framework assumes that effective monitoring consists of three factors:

- a monitoring plan,
- process management, and
- dependence on an objective for which it is undertaken.

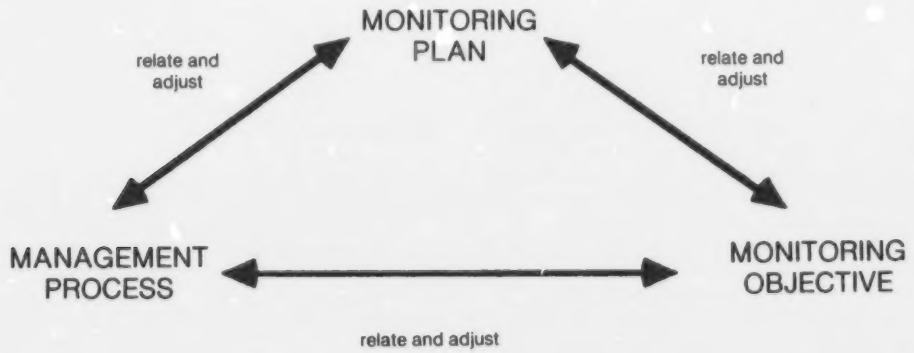
This triad is in a continual process of readjustment to maintain maximum fit or congruence in a complex and uncertain situation. Experience has shown that no monitoring program is embedded in a static situation. All have elements of the unexpected; hence, the need for flexibility. Depending upon their level of congruence, these three factors can reinforce one another, or work against each other to inhibit effectiveness.

Each element of the triad is described in turn.

The first element is the **monitoring plan**, which involves *scoping, data collection and analysis, interpretation,* and *feedback*. In outline, it conforms to the descriptions in the SIA literature about the steps to be followed. We believe it is an excellent *post hoc* description. Our key finding for each of these steps is as follows.

Scoping: At the present time, the scope of monitoring programs is remarkably homogeneous, regardless of the project type under consideration or the characteristics of the community. Therefore, we believe that scope is driven by the discipline represented by the monitoring team, rather than by the interests of all affected parties. While this may be appropriate in some situations, we believe it sets the stage for a scope which can be narrow, elitist or irrelevant. Therefore, we believe in the need for a model of the situation being monitored, developed with the consultation of all affected parties. The resultant model will guide the scope.

Data Collection and Analysis: A pervasive myth in SIA is that pooling the data routinely collected by government departments provides a cost-effective foundation on which to build a monitoring program. Reliance on these sources, even



The Monitoring Triad

by another government department, can be a most expensive mistake. While we have heard that the quality of such data is usually good, there are problems with access, especially if confidential records are involved; with motivation of staff to collate and release data; with timeliness; with inappropriate units of analysis; and/or with boundaries of analysis. In other words, while use of government-collected data seems fine in theory, conditions must be "right" for it to work at all in practice.

Interpretation is often a social process of negotiation, rather than an objective result of data analysis, especially in impact management. It could only with difficulty be otherwise, given the present state of the field. The study of change, which is what monitoring should be, has major methodological obstacles in terms of the ability to assess actual change and its significance. Many practitioners ruefully remark, after collecting large amounts of data, that the data does not speak for itself. Thus, in impact management situations, we suggest that assessments of significance be based on the following questions: May we do something about it?— an issue of mandate or jurisdiction; Can we do something about it?— an issue of what is possible; and, Will doing something about it make a difference, preferably in the positive direction? — an issue of what is under one's control.

For *feedback* to be successful, the monitoring program must be user-oriented. Moreover, so that monitors have a realistic expectation of what that implies, it is important to understand that successful use is not always immediate and direct.

The second element is the **management process** involving concurrent tasks related to a *process of analysis, organizational arrangement,* and the *participation of the parties-at-interest*. It is through effective management of these processes that value differences among the various parties can be displayed, conflicts resolved, and a good working relationship established.

Process of analysis must be orderly and systematic; however, this does not mean it is logical and linear. It is a series of pulses, consisting of expansions which move outward to gather and consider alternatives, information, and ideas; and contractions which move inward to focus, evaluate, and decide.

Organizational arrangement, often called organizational structure, should promote co-operation among interdependent units or agencies. Interdependency is a given, because monitoring is a complex undertaking. While there are no recipes for "the best" organizational arrangement, we know of several ways to ensure failure: inadequate funding, e.g., ambitious terms of reference far in excess of the funds available; mismatches between responsibility and authority, e.g., a situation in which the monitors have all the responsibility for ensuring a program's success but no authority to require any one to do anything for that success; and inappropriateness for the situation, e.g., a fixed or bureaucratic program, dealing with a monitoring situation that is very fluid or dynamic.

Participation of the parties-at-interest ensures the appropriate involvement and participation of the parties-at-interest, by managing the relationships. This involves: inclusion — inviting the relevant parties to participate; receptivity — creating an atmosphere of trust; and commitment. While commitment is essential to effective monitoring, it is difficult to engender because of the general lack of interest in monitoring by the public, proponents and government agencies; the lack of regulatory requirement for it; and the lack of direct benefit that monitoring sponsorship has for many members of the private sector. These barriers serve as disincentives to monitoring, making it the most vulnerable aspect of the SIA process.

In our opinion, the third element, the **monitoring objective**, does make a difference in both the monitoring approach and the management of the monitoring process. In this report, two types of objectives are examined, impact management and prediction. Unfortunately, both have many meanings. Impact management monitoring is used to show when intervention may be needed and to show the results of intervention. Prediction has three meanings: verifying prediction, improving the predictive capability of SIA, and making short-term forecasts. It is this last meaning of prediction — making short-term forecasts — that results in the assumption that impact management monitoring and prediction monitoring are the same. We believe, however, that impact management monitoring and prediction monitoring are incompatible, because the former assumes intervention will happen and is set up for it, while the latter requires that the monitoring team not intervene in the situation being monitored. This is further supported by the fact that the data systems and management processes required of impact management and of prediction monitoring differ greatly. The former requires a highly responsive, user-oriented data system and management process because of the need for immediate, directly useful information on which to base action. The latter has no such requirement for immediacy or direct utility.

LESSONS FROM THE CASES

We selected three cases with which to verify the framework: the Keephills power station in Alberta, built by TransAlta Utilities Corporation; the Atikokan power station in Ontario, built by Ontario Hydro; and the human system research of the Alberta Oil Sands Environmental Research Program (AOSERP). There are many lessons that can be learned from each case, but two are particularly important: the key role of management process in effective monitoring; and the impossibility of satisfying impact management and prediction objectives at the same time.

On the surface, the power station cases at Keephills and Atikokan have many elements in common. Both concern coal-fired power stations proposed during the energy boom and built by utilities. Both monitoring programs were implemented largely for impact management and to give the proponent credibility, and have been ongoing for over eight years. The major parties in both are still very much committed to monitoring and believe their programs are successful and effective. We, too, found them to be effective; and the community members in both cases would recommend such an approach to other communities. Here the similarity ends.

On the one hand, the Keephill's approach is largely proponent- and community-based; the proponent and members of COKE, the Committee on the Keephills Environment, share the decision making. The major data are people's observations and concerns, which are "brought to the table" for discussion. It is a labour-intensive, highly consultative and expensive process; and it works. It is a fine example of monitoring based on the sociopolitical paradigm, which assumes that an open, participative process results in better decisions.

On the other hand, the Atikokan approach is solely proponent- and community-based, but in this case the community is represented by the local authority, the Township of Atikokan. The proponent and the local authority have a legal agreement, in which largely quantitative monitoring data are used to verify impacts. Compared to Keephills, the Atikokan approach is less labour-intensive, and less expensive (about $1.75 million including compensation, at Atikokan, compared to $8 million, which included building a new hamlet, at Keephills); and it also works. It is a fine example of a program designed under the technical paradigm, which assumes that better information, particularly quantitative, results in better decisions.

At Atikokan, however, the predicted effects did not occur. Because methodology for detecting and attributing change is not well developed, the monitoring data were not always as useful as originally expected. In response to the unexpected, the proponent resorted to an increasingly interactive process. Over time there was more emphasis on the process of negotiation than on "hard data." We believe that as a result the Atikokan program has become less technical and more sociopolitical, that is, more oriented toward developing consensus, through presenting the viewpoints of parties with different planning values. We believe this is an important finding.

There is an ongoing argument in SIA that the sociopolitical and technical paradigms are irreconcilable. What the Atikokan case suggests is that, over time, because of methodological difficulties in the study of change and the need to interact with other parties-at-interest with very different values, needs, and assumptions, effective monitoring will tend toward the sociopolitical. Ironically, some participants in the Keephills case suggested the need for more hard data. We believe that monitoring may be the situation in which the sociopolitical and technical paradigms can be blended, rather than being viewed as opposite ends of the spectrum.

We have already stated our belief that monitoring for impact management and for prediction are incompatible. The human system research of AOSERP is a case in point. It had both objectives, and as we demonstrate in our report, was ineffective in meeting them. Of course, this is hardly conclusive evidence for our argument; we add to it two others, the SIA monitoring at Revelstoke in British Columbia and the Huntly Monitoring Project in New Zealand. Here are three different cases, which basically have nothing in common other than sharing the dual objectives of impact management and prediction monitoring. All cases were unable to meet both objectives. Thus, we believe the state of the practice could be improved considerably if monitors did not attempt to satisfy both objectives in the same program, at the same time.

OUTSTANDING ISSUES

We have briefly examined how SIA and EIA monitoring processes might be more closely linked. Areas of potential linkage include: changes to resource-based economies, environmental health, recreation, and environmental perceptions and attitudes. We believe linkage is an issue; however, it is not recognized as a priority within the impact assessment community. To improve the integration of social and biophysical monitoring processes we make three suggestions: that government agencies develop the requirement for such integration; that funding agencies support long-term research and manpower development in this area; and that both public and private sector agencies with impact assessment responsibilities integrate their SIA and EIA staff.

RECOMMENDATIONS

At the present time, monitoring is seldom undertaken. The current source of SIA Statement predictions is unverified predictions made in previous SIA Statements. The current practice flourishes because of the lack of alternatives. We propose three alternatives: establishing a monitoring data base containing the empirical results of project audits and of monitoring studies, for future use; further regulatory guidance to encourage monitoring and/or follow-up on projects to identify the actual outcomes; and establishing professional development for practitioners. Moreover, in our opinion, SIA in general and Canadian SIA in particular, suffers from the absence of environmental social scientists and the resultant environmental social science research that is the foundation for improvements in practice. At the present time, research and development in this area is haphazard. Increased opportunity for training and research should be encouraged by funding agencies.

CHAPTER 1: OVERVIEW

INTRODUCTION

This report develops an analytical framework that can be widely applied to evaluate the effectiveness of approaches to social impact assessment (SIA) monitoring. The framework is based on a review of the literature, extensive consultation with various stakeholders, and verification using three case studies.

Social impact assessment, or socio-economic impact assessment, is "an area of systematic inquiry, which seeks to investigate and understand the social consequences of planned change and the processes involved in that change" (CEARC 1985: 2). These include: economic changes, such as effects of new patterns of employment and income; changes in use of natural resources as a result of project development, for example, changes in ability to exist by subsistence, or changes in recreational opportunities; changes in community infrastructural requirements, such as the need for increased sewage capacity or more schools; and changes in the economic and social organization of communities, resulting from one or a combination of the effects noted above.

Monitoring is "a control activity involving the measurement of change(s)" (Krawetz 1981c: 10). There are similar definitions in the SIA and environmental impact assessment (EIA) literature to convey the notion of observation, keeping watch over, and control (Carley and Bustelo 1984; Conover 1985; Kopas 1980). Monitoring can apply to a variety of activities: keeping records of expenses and comparing them to budget forecasts; watching animal behaviour and interpreting it with the changes of season. In this report, we are concerned about monitoring as a generic activity and as a part of the SIA process.

Where Does Monitoring Fit into SIA?

Normatively, the SIA process consists of 10 steps (see Wolf 1983b)

- scoping
- problem identification
- formulation of alternatives
- profiling
- projection
- assessment
- evaluation
- mitigation
- monitoring
- management

SIA monitoring was introduced by Wolf as a way of improving the predictive capability of SIA, so monitoring for SIA improvement is the underlying assumption of all SIA monitoring exercises. Also implied is the idea that the monitoring results will be useful to stakeholders involved in the project being monitored, particularly if they are involved in impact management. This is the normative view of the relationship between SIA and monitoring, i.e., what leading practitioners say it ought to be.

The grounded view, based on how monitoring actually occurs, compares the SIA steps to the typical process, as practised. The findings are well known:

- Monitoring as practised bears no relation to the generation of future SIA Statements. In general, SIA practitioners cross-reference other SIA Statements as the major data base. In other words, they make predictions based on unverified, past predictions. Therefore, monitoring, if it occurs at all, does not deliberately relate to the SIA process or directly to SIA improvement. It often exists in a post-decision vacuum.

- The incentive to do otherwise is lacking, in part because relatively few cases of SIA monitoring in Canada are available: some utilities have undertaken monitoring for some projects, e.g., B.C. Hydro, Ontario Hydro and TransAlta Utilities; NOVA (Giles 1985) and the Department of Indian Affairs and Northern Development have monitored pipelines; the Government of Alberta initiated monitoring in the oil sands; preparations are underway for community-based monitoring of a special waste treatment and disposal facility at Swan Hills, Alberta; and there are proposed programs in the Beaufort Sea and mention of such for offshore oil developments.

The Context in Which Monitoring Takes Place

Little has been written about the conditions under which a monitoring program is managed and their implications for administration. There are several reasons for this: the newness of the process; professional embarrassment — fear of admitting failure; the lack of appropriate vehicles for disseminating information related to monitoring management; the lack of incentive for those in proponent organizations to publish; and lack of interest in the management process, reflected in ignorance of the management, knowledge use or technology transfer literatures (Fookes, Leistritz, pers. com.) Without information on the actual experiences of managing

monitoring, the transfer of learning experiences from one case to another or to the SIA literature in general is haphazard, if it exists at all. Programs repeat past mistakes. Therefore, we think that examining the management context is important because it sets the stage for facilitating or inhibiting the monitoring program.

In our view, the most important factors to recognize in SIA monitoring are the complexity and uncertainty surrounding its management. Most SIA monitoring programs operate under conditions of high complexity and varying degrees of uncertainty, as suggested in Table 1, based on Axelsson and Rosenberg (1979:45-62).

In our experience, the most turbulent, that is, the most highly complex and highly uncertain contexts appear to be those associated with the least effective monitoring programs. One model for such circumstances is the "garbage can" or "organized anarchy" model of organizations. "Organized anarchies are decision situations or organizations which are characterized by inconsistent and ill-defined preferences, unclear technology, and fluid participation in the decision-making process" (Martin 1980: 8). In SIA monitoring there are at least three examples: the Huntly Monitoring Project in New Zealand, Revelstoke in British Columbia, and the human system research of the Alberta Oil Sands Environmental Research Program (referred to throughout this report as AOSERP). In our opinion, the context within which they operated made it extremely difficult for them to carry out their task.

Regardless of how difficult it is to deal with, and in spite of human desire for a more predictable state, turbulence is a fact of life in many cases. We suggest that SIA monitoring often occurs within the context of instability; that is, "it is not a stable environment where a research problem can be identified and a study designed to report on that problem some months later. The problems will change and it may be necessary to alter the research design" (Durlak and Morgenstern 1977: 33). Boundaries of a monitoring study will continually change, the potential result being a situation where the project cannot answer its original questions and uncovers unexpected information. "However, if the research directors alter the design in mid-study, their detractors will undoubtedly discount the results as unreliable, and if they rigidly maintain a design that is outdated they will be accused of irrelevance" (Durlak and Morgenstern 1977: 33).

ORGANIZATION OF THE REPORT

Our terms of reference, described in Appendix C, required several research thrusts. We describe our approach, and the structure of our report, in the following sections.

Developing a Framework for Effectiveness

The terms of reference required us to develop an analytical framework that could be widely applied for evaluating the effectiveness of SIA monitoring. The analytical framework for evaluating the rationale, requirements and responsibilities for pre- and post-decision monitoring programs is based on our own experience, discussion with practitioners, and a review of the literature; and verified by three case studies.

We extended the literature review beyond the Canadian SIA literature to include material from the United States and New Zealand. Moreover, we included literature on environmental impact assessment, knowledge use, management and organizational development, interdisciplinarity, and program evaluation.

We discussed SIA monitoring with a number of practitioners in the SIA and environmental impact assessment fields, as well as with decision makers, community members, academics, proponents and representatives of government agencies. The points of view we express in this report are the result of discussions and research over the past seven years.

Table 1
Degrees of Complexity and Uncertainty

		COMPLEXITY	
		Low	High
UNCERTAINTY	LOW	Routine, rational choice. Goals are limited and clear; e.g., compliance monitoring. (Smaller number of similar factors which basically do not change.)	Bureaucratic, incrementalism due to abiguous, competing objectives. (Large number of dissimilar factors which basically do not change.)
	HIGH	Sociopolitical process, strategic decision making. (Smaller number of similar factors in continual process of change.)	Turbulence, garbage-can decision making due to ambiguous, undefined goals and high variability. (Larger number of dissimilar factors in continual process of change.)

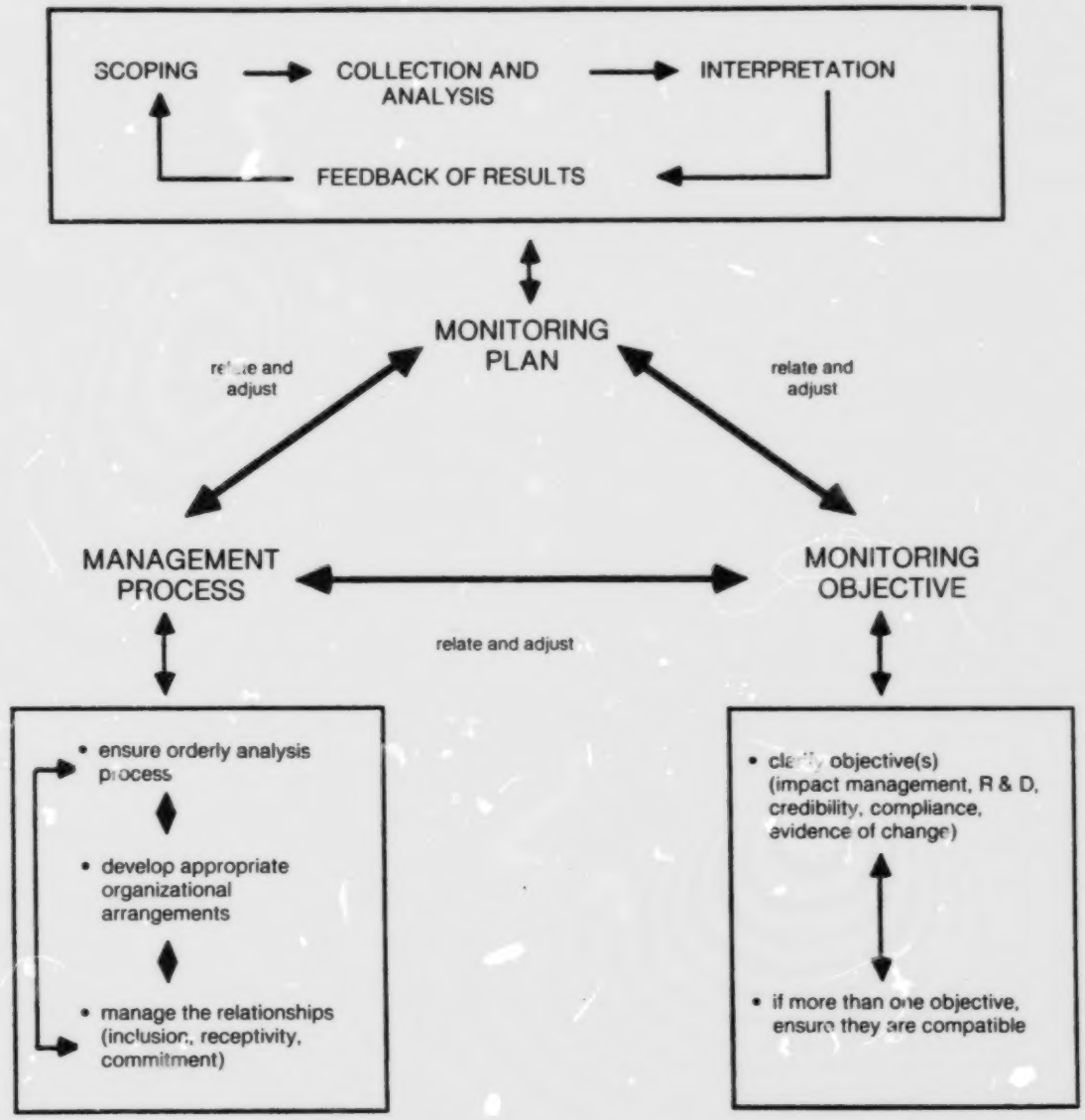

SCOPING
COLLECTION AND ANALYSIS
INTERPRETATION
FEEDBACK OF RESULTS
MONITORING PLAN
relate and adjust
relate and adjust
MANAGEMENT PROCESS
MONITORING OBJECTIVE
relate and adjust
• ensure orderly analysis process
• develop appropriate organizational arrangements
• manage the relationships (inclusion, receptivity, commitment)
• clarify objective(s) (impact management, R & D, credibility, compliance, evidence of change)
• if more than one objective, ensure they are compatible

Figure 1. The Monitoring Triad

The framework we develop is based on the assumption that SIA monitoring occurs in a complex and uncertain situation. It assumes that effective monitoring consists of three factors:

- a monitoring plan, involving scoping, data collection and analysis, interpretation and feedback; this plan is described in Chapter 2;
- process management, involving a process of analysis, organizational arrangement, and the participation of the parties-at-interest; this process is described in Chapter 3;
- dependence on an objective for which it is undertaken, specifically, in this report, for impact management or prediction; this is described in Chapter 4.

The framework is shown diagramatically in Figure 1. It is revisited in Chapter 5, where the premises, often stated in Chapters 2, 3, and 4 as conclusions, are specified. Examples from the three cases we analysed indicate support or lack of support of the premises. We suggest that the framework is generic to monitoring.

Outstanding Issues

In Chapter 6 we discuss the framework as it relates to three outstanding issues: pre- and post-decision monitoring, applicability to other cases, and the sociopolitical and technical paradigms.

- Applicability to pre- and post-decision monitoring: There are two views of the timing of monitoring: that it should be used throughout the SIA process as a planning process (i.e., pre-decision monitoring); and that it should be a post-decision exercise, not necessarily related to the SIA Statement. We believe that the framework can handle both views.

- Applicability to other cases: The rudiments of this framework began with our work on the Huntly Monitoring Project in 1980. At that time, six cases were tested. Over the years the framework has been refined and informally tested as situations occurred. While the framework has been modified with new data, the general triadic model holds up very well across a variety of cases and we believe that the idea that monitoring involves a monitoring plan, process management, and a monitoring objective, is generic.

- Applicability across the two dominant paradigms in SIA — sociopolitical and technical: We suggest that the framework can handle both, and, more importantly, that monitoring offers the potential for the resolution of the two paradigms. Our cases show that over time monitoring becomes more process-oriented. In other words, even if a project starts out with a technical paradigm orientation, the complexity and uncertainty of the situation make it become more process-oriented; that is, it will follow the sociopolitical paradigm.

In Chapter 6, as requested in the terms of reference, we discuss the potential for linkage between EIA and SIA monitoring. We believe that there is potential for linkage but that many barriers prevent these opportunities from being realized. Appendix B provides support for our arguments.

Recommendations

In Chapter 7, we offer 10 recommendations under five topic headings:

- strengthen the immediate contribution of SIA monitoring to help manage project impacts more effectively;

- improve predictive analysis over the longer term;

- indicate centres of responsibility for implementing SIA monitoring programs;

- suggest how social and biophysical monitoring processes might be more closely linked to produce an integrated approach to project implementation; and

- areas for further research.

Workshop

Our terms of reference required a formal consultation with SIA practitioners. This was held on February 28, 1986 in Edmonton. Workshop participants included Natalia Krawetz, William MacDonald, and Peter Nichols and:

- Ray Baril of Ontario Hydro, Toronto

- Mary Pat Barry of TransAlta Utilities, Edmonton

- Tony Dorcey of the Westwater Research Institute, Vancouver

- Felicity Edwards of F.N. Edwards Consultants, Edmonton

- Gerry Glazier, representing the client, CEARC

- Syd Hancock of Atikokan, Ontario

- Garry Prokop of TransAlta Utilities, Calgary

- John Shires of Alberta Environment, Edmonton

- Erin White from the community of Keephills, Alberta

Most participants were involved in the cases we reviewed; additionally, academic and government interests were represented. Several of the participants are practitioners. We drew on the experiences of the participants to discuss issues related to the cases and the relevance of these issues to the monitoring framework. The results of the workshop have been incorporated in the report.

CASE STUDIES

The terms of reference required us to analyse and evaluate three cases, and to base the framework on our analysis. There are not many Canadian cases to choose from, so we selected ours based largely on accessibility. As a result we chose:

- the Keephills power project, an example of impact management monitoring;

- the Atikokan power project, an example of impact management monitoring; and

- the human system research of the Alberta Oil Sands Environmental Research Program (AOSERP), an example of a program with dual objectives for prediction and impact management monitoring research.

The cases are described in detail in Appendix A.

The Effectiveness of Three Approaches to SIA Monitoring

As required by the terms of reference, we review and evaluate the three case studies, in terms of effectiveness, that is, the degree to which they achieved the various management objectives inherent in each case. To us, effectiveness means the degree to which the program focused on appropriate goals and objectives, and the degree to which these goals or objectives were achieved. Effectiveness is not to be confused with efficiency — the production of maximal results with minimal resources. Effectiveness and efficiency are not necessarily related.

The evaluations show that, in general, the impact management programs at Keephills and Atikokan have been successful, although the demonstration of causality remains a major methodological issue. The human system research of AOSERP, the impact prediction case, however, did not achieve its objectives and it is doubtful it could have, given the conditions at the time.

We will present a brief summary of the cases in this section. The reader is urged to consult Appendix A for the full details of each case and the evaluation of its effectiveness. While examples from the cases are used throughout the report, they are no substitute for the understanding that will be gained by reading the full case studies in Appendix A.

The Keephills Power Project

Keephills is a rural community of about 700 people, 80 kilometres west of Edmonton. Only a few families live in the hamlet of Keephills, from which the region takes its name. In 1976 TransAlta Utilities Corporation proposed to build an 800 megawatt coal-fired power plant north of the hamlet and to strip-mine coal in the surrounding area. The power project was approved by the Government of Alberta in December 1977.

With the announcement of the power plant, the community found itself in a highly turbulent situation. People had to organize quickly and respond to changing events. Initially the future of the hamlet was in doubt, since it was to be strip-mined; and the potential impact on the entire community was uncertain. At the same time as the announcement of the proposed plant, TransAlta began to negotiate land purchases from the residents. In short, suddenly a rural community was in the midst of a major energy development.

To deal with this situation, TransAlta initiated an extensive program of community contact, which is still in existence. TransAlta recognized that it needed community participation; the company had previously lost a plant site elsewhere because of major opposition. In addition, the new Alberta coal policy supported both early public disclosure of plans and public involvement in the overall decision process. TransAlta encouraged the community to organize itself and become involved.

In order to preserve community cohesion, at an early public disclosure meeting the company agreed to relocate the hamlet to an area that would not be mined. At the public hearings in March 1977, the company formally committed itself to moving the hamlet, and then worked with the community to develop the new hamlet.

Two kinds of monitoring, participant observation and surveys, were developed at Keephills. Both were concerned with impact management. The community was involved in participant observation, relying on residents to report impacts. They could report impacts to the company in three ways: by contact with company staff in the area; through the Committee on Keephills Environment (COKE); and through the Keephills Power Project Steering Committee. COKE was formed by residents as a vehicle to represent them at hearings or in negotiations with the company. The Steering Committee was formed as one of the conditions of project approval. Representatives from the community, the company, the local authority, and several provincial government departments sit on the Steering Committee.

The company hired consultants to conduct a series of three surveys in 1978, 1981, and 1984. The surveys focused on residents' perceptions of their involvement in decisions concerning the project, how the project affected them, or their observations on the different parties-at-interest, such as COKE, the company, the government, and the Steering Committee. The company then used this information to verify the impacts that had been reported through COKE or the Steering Committee, to ensure that corporate credibility was intact, and to develop an approach to future interactions.

The community continues to have extensive interaction with the company. Both COKE and the Steering Committee are active, and residents regularly see company staff in the field. Many residents work in the plant or mine.

Neither the company nor the community formally developed objectives for their activities, or for the monitoring that has gone on. Both parties responded to the issues as they arose, and, early in the process, involved the social consultants in developing various approaches to resolving different issues. While the company submitted an SIA Statement at the hearings in 1977, it has not used the Statement as a working document. As a result, we have constructed objectives as a way to see how successful the company and community have been in meeting their needs.

We believe that the (constructed) objectives for the company were project control, impact management, and corporate credibility with the community and government. The community's only (constructed) objective is impact management. We believe both parties have met these objectives, based on our review of reports, interviews with participants, and input to our workshop.

TransAlta is committed to its approach and has learned the value of delegating a considerable amount of decision-making authority to the community. As a result of their experience, the residents of Keephills have learned the importance of community-based action and feel strongly that communities should have more power, more support from government, and more access to expertise. They feel that current government legislation sets the scene for an inherently inequitable process, that is, one where corporate power is greater than that of the community. Therefore, they recommend such a process, with modification, for other communities. They also recommend that monitoring continue through the operational phase of the project.

The Atikokan Power Project

The Township of Atikokan is in northwestern Ontario, about 200 kilometres from its nearest urban centre, Thunder Bay. In 1975, Ontario Hydro, a major electrical utility, proposed to build an 800 megawatt coal-fired generating station in the township. In general, the citizens of Atikokan were pleased with the prospect of diversifying their economy, then a single-

industry community based on iron mining. Government approval to proceed was granted in 1977.

Ontario Hydro planned to implement SIA monitoring of the project, for two reasons: Hydro's policy "is that communities should not suffer as the result of construction and operation of a generating station" (Walker 1979: 2-3); and the SIA Statement had predicted a "boom-bust" cycle which would require impact management, and hence, impact management monitoring.

In 1978, the Township of Atikokan and Ontario Hydro signed a legal agreement to jointly sponsor a comprehensive monitoring program to provide the basis upon which the Township would be compensated for impacts caused by Hydro. The Township hired a respected local resident to serve as the monitoring co-ordinator; and, largely with community studies planners from Hydro, monitoring has been going on for eight years. By all accounts, the co-ordinator has been the key to the program's success because of his extensive knowledge of the area and his ability to gather data.

Formal and informal objectives have been met: impact management, the maintenance of Hydro's credibility in the community, and maximal compensation for the community; but we are not certain that the approach used is totally effective. The reason for our uncertainty is that the "boom-bust" cycle predicted in the SIA never materialized. Instead, the recessionary economy of 1979-81 had several unpredicted effects: two iron mines, the township's major employers, were closed, with a loss of over a thousand jobs, yet massive out-migration did not occur because there were no opportunities elsewhere; and the Hydro station was downsized from 800 to 200 megawatts. Ironically, the industry that was to diversify the local economy is now the largest employer. Impacts from the station's construction have been minimal and largely beneficial, because the station has cushioned the township from the consequences of the economic downturn. The monitoring data and the model of analysis used are unable to show the exact degree to which this cushioning is due to the station. (This is not unusual in SIA monitoring.)

The Township has learned the value of a legal agreement and endorses the concept for other communities. It is pleased that Ontario Hydro located its station in Atikokan. Ontario Hydro has learned about the importance of extra-local linkages in affecting impacts; about the key role a local resident can play in providing a context for interpreting data, based on local experience; and about the importance of negotiating the significance of impacts rather than relying solely on the inspection of quantitative data.

Human System Research in AOSERP

In 1975 the Governments of Alberta and Canada signed a five-year agreement, renewable for another five years, to spend $4 million a year on AOSERP. Most of the research focused on the biophysical environment — the air, land and water systems; however, provision was also made for research on the human environment, or human system. Only the Government of Alberta funded research in the human system.

From 1975 to the present time, AOSERP has undergone numerous changes. Initially, eight technical committees developed and managed research projects. In 1977 a reorganization created a central management group, and divided research into the air, land, water, and human systems, each with a system manager who was assisted by a scientific advisory committee. In 1979 the Government of Canada withdrew from AOSERP, and Alberta Environment continued funding. AOSERP was integrated with the Research Secretariat, a line division in Alberta Environment, in 1980. That same year the human system committee was disbanded, and all human system research was discontinued by 1982. Our analysis is concerned with the research in the human system, and the attempts of the human system committee to develop research for impact management and impact prediction.

The human system committee had representatives from six different government departments and agencies, from the town of Fort McMurray, and from industry. During its five-year existence it had four chairmen and funded numerous projects in four research areas: exploratory studies, field studies, a conceptual framework, and a compendium of economic, demographic, and social statistics. The latter two studies were developed specifically for monitoring and impact prediction research, and were also meant to integrate the diverse projects.

The committee formulated several objectives. Inherent in the objectives was the monitoring of conditions in the oil sands, predicting impacts, and researching ways to manage the impacts.

For a variety of reasons, the human system committee was unable to meet its objectives. The situation in the oil sands was dynamic and complex, and resource development had been proceeding rapidly even before AOSERP began. The committee tried to meet the diverse needs of its member agencies through the research projects; consequently it was difficult to develop a project which could satisfy each of the agencies. Although a number of research projects attempted to develop prediction models, the state of SIA at the time was such that none of the models were suitable, nor were they acceptable to the committee or scientific community. The committee did not have the authority to ensure a degree of success. Thus, government agencies were not committed to providing the necessary data for prediction studies, nor was there any indication that mitigative measures for impact management would be put in place, if they were identified through the research.

Given these conditions, and the context in which the committee existed — turnover in its members, conflict, reorganizations of AOSERP, and lack of relevance to the needs of Alberta Environment — it is doubtful it would have been able to meet its objectives, even if it had not been disbanded in 1980.

CHAPTER 2: DEVELOPING THE MONITORING PLAN

INTRODUCTION

According to the SIA literature (Wolf 1983), monitoring consists of:

- devising a monitoring plan;
- measuring actual versus predicted impacts; and
- feedback of results to policy makers and publics.

Related to SIA and EIA frameworks, monitoring includes:

- scoping, that is, establishing terms of reference;
- collection and analysis based on repeated measurement of indicators;
- interpretation of the relative importance of change based on established criteria, for example, predicted impacts; and
- feedback of results to policy makers and the public.

These steps are iterative as shown in Figure 2. Each step is described below.

SCOPING

Regardless of how much work is done in an SIA Statement, practitioners state that baseline must be updated because of the length of time between completion of an SIA Statement and project approval. Many SIA practitioners say complete revisions are required because the nature of the situation changes significantly, for example, a plant is downsized; or new interest groups or stakeholders emerge with different agendas, such as construction managers or other players in the regulatory process. Those who have been involved in an iterative process from the beginning, that is, one in which there is essentially no break between the onset of SIA and monitoring, state that revisions are a fact of life because the nature of the situation being monitored changes. If no SIA Statement is prepared, then monitoring begins at "ground zero": affected groups must be identified, impact categories and indicators selected, and baseline undertaken to the extent possible, for example, through secondary sources or immediate measurement.

Table 2 shows the scope of four monitoring projects: a typical monitoring project based on a review of 14 energy projects; the Atikokan case whose scope is detailed further in Table A-1 of Appendix A; Giles's report on NOVA's monitoring of eight pipelines; and the Keephills case, whose scope continues to evolve. The first three are based on planning models and as a result focus on demographics, economics and community infrastructure. In practice the social aspects, such as lifestyle or attitudes, are a small, often distinct part of such programs. The scoping categories are fixed, although the amount of attention each gets over time may vary. The fourth example, Keephills, has a scope based on the interests of the community and the company. Unlike the other three examples, the categories used at Keephills shift as concerns are resolved or new ones surface. Only in the Keephills example are biophysical concerns included as part of SIA monitoring.

In theory, the scope of a monitoring program should be determined by the nature of the project(s) being monitored, the nature of the affected communities, and the resultant interaction of these two. In practice, this is not necessarily the case. For example, the typical monitoring project described in the first column of Table 2 is based on 14 relatively different energy projects — including a hydro-electric dam, coal-fired and nuclear power plants, a coal gasification facility, oil shale

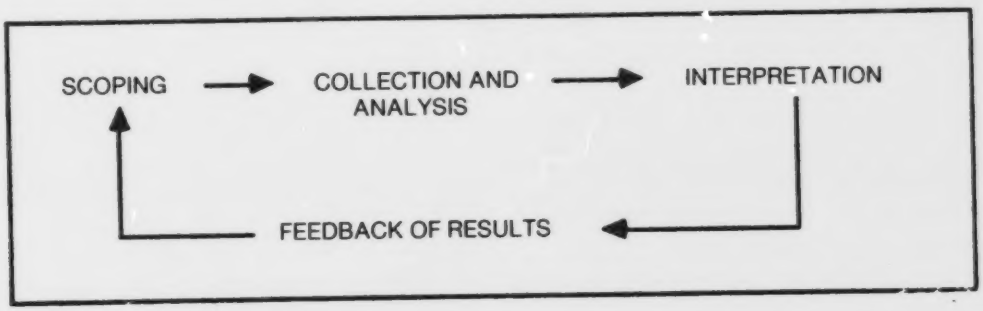


Figure 2. The Monitoring Plan, as Described in the Literature

extraction facilities, coal mines, and oil sands plants — in various communities, in different parts of the world. How can such different projects all monitor the same things? To some extent, certain factors are probably generic, but we do not believe this accounts for the remarkable similarities across cases.

We believe this homogeneity is due to the dominance of particular disciplinary interests in the monitoring exercise. For example:

- The bureaucrat tends to emphasize those variables that are within the mandate or jurisdiction of the agency repre-

Table 2
Scope of SIA Monitoring Programs

TYPICAL	ATIKOKAN	GILES	KEEPHILLS
Project			
WORKFORCE — present — projected	POPULATION	POPULATION INFLUX	HAMLET RELOCATION
WORKER CHARACTERISTICS	EMPLOYMENT & LABOUR SUPPLY	ACCOMMODATION	LAND ACQUISITION
Community	HOUSING & PROPERTY VALUES	RECREATION	MINE RECLAMATION
ECONOMIC	REGIONAL DEVELOPMENT	COMMUNITY SERVICES	HIGHWAYS
— retail sales — employment — assessed evaluation — personal income	MUNICIPAL ADMINISTRATION & FINANCE SOCIAL ASPECTS	SOCIAL CONDITIONS	COAL DUST*
DEMOGRAPHIC — population	LIFESTYLE & CULTURE	EMPLOYMENT	WATER WELLS*
COMMUNITY SERVICE — housing — public safety — health care — education — transportation	MUNICIPAL SERVICES & FACILITIES	LOCAL PURCHASE	NEW SCHOOL
SOCIAL — social problems	TRANSPORTATION & COMMUNICATION	ATTITUDES	NEW COMMUNITY CENTRE
— community attitudes	EDUCATION		PUBLIC PARTICIPATION
FISCAL	SOCIAL SERVICES		LAND LEASING
	RECREATION & TOURISM		PLANT LEASING
	HEALTH & SAFETY		ROAD DAMAGE
			ENVIRONMENTAL QUALITY*
			END LAND USE*
			* recent issues

Typical: based on review of 14 SIA monitoring projects in the United States, Canada and New Zealand, commissioned by Batelle. **Atikokan:** for information on variables monitored see Appendix A, Case 2. **Giles** (1985), monitoring of eight pipelines. **Keephills:** for further information see Appendix A, Case 1.

sented, consistent with an administrative worldview of disjointed incrementalism (Braybrooke and Lindblom 1963). The AOSERP case illustrates this well. For example, some agencies lobbied against funding studies on oral history of the area on the grounds that the data would not be useful to their mandates.

- Sociologists recommended the study of integration, differentiation, extra-local linkages and stratification (see FEARO 1980; Thompson and Branch 1980).

- Those with planning backgrounds propose frameworks which concentrate on supply and demand differences in service delivery systems, for example, sewers, housing, water, schools (see Lawrence and Wright 1983). The Ontario Hydro model illustrates this well, and includes the Atikokan case study.

- Those with backgrounds in economics concentrate on demographics, public finance and employment (see Leistritz *et al.* 1982).

- Psychologists focus on psycho-social impacts — stress, conflict, perception (see Edelstein 1982).

Needless to say, no single framework is accepted, although a dominant one is shown in Table 2 as a typical case. In short, in spite of the fact that many parties-at-interest bring multiple versions of the "truth" to a scoping exercise, the monitoring frameworks generated are remarkably homogeneous.

In summary, scoping sets the monitoring boundaries in terms of what is monitored, why, how and how deeply. Regardless of when it occurs, scoping is an essential part of monitoring plan development, because "the issues or problems which actors identify as their priorities, establish a context for the research that far outweighs the importance of methodology" (Durlak and Morgenstern 1977).

COLLECTION AND ANALYSIS

Collection and analysis include data collection, storage and retrieval, and collation of data by factor, in order to examine relationships among data elements within and across factors. The quality of data collection and analysis is affected by access, timeliness, and expertise.

A major concern addressed in the literature is lack of access to existing data such as that collected routinely by government agencies. In our experience, inaccessibility is the result of several factors: concerns by the agencies that client confidentiality may be breached, the fact that agencies have other priorities, or staff resentment at being "free labour" for what may be perceived as a highly funded, external project. For example, in prediction monitoring, peripherally involved agencies have little incentive to make data accessible because they do not benefit by doing so. This happened to the Huntly Monitoring Project in New Zealand. Similarly, for AOSERP, described in Appendix A, the fact that agencies had not committed themselves to providing or collecting data for the AOSERP compendium would have been a major barrier to data access, had the project continued.

Strategies for improving access include conducting primary data collection by survey, which can be expensive, and using local residents for data collection so that local agencies are more willing to co-operate. For example, in the Atikokan case, the monitoring co-ordinator is a local resident. The co-ordinator's strategy for improving data access in Atikokan involved boosting morale. The monitoring program depended on data from several agencies which did not directly benefit from allowing access (as they were provincial government agencies they would not be eligible for compensation if impacts were verified). To enhance co-operation, the co-ordinator invited agency representatives to luncheons whenever Ontario Hydro personnel from head office came into town; luncheon discussion dealt with the importance of the role these agencies played and acknowledgement of co-operation.

The provision of timely information to decision makers is an important aspect of impact management monitoring, according to practitioners (Davidson 1984; Halstead *et al.* 1984).

Another issue that arises during analysis is that of expertise: who should collect and analyse the data, a technical expert or a local resident? While a continuing theme in the SIA literature is the importance of community involvement in data collection, practitioners' opinions vary. One practitioner mentioned that an Indian band which was an affected party in numerous SIAs offered to compile data on a regular basis; they could then sell the data to consultants. The practitioner replied that each consultant would have different data needs, at different levels and frequencies. In the end the collection would have to be re-done or require extensive analysis at greater cost than data collection for a specific SIA. The degree of accuracy to be expected of non-experts is a related concern. As several practitioners noted, accuracy is not guaranteed, particularly if the program depends on data from agencies which are not used to providing it in the form required.

Others have a different opinion and train local people in data collection, albeit for a specific SIA. For example, Justus and Simonetta Development Consultants Ltd. (1979) trained members of the Cold Lake Band to gather data from other bands on impacts from oil sands development.

Local residents are involved in data collection at Atikokan and at Keephills. Practitioners at Ontario Hydro support the use of a credible, local resident to collect data and serve as a liaison. They stated that the role played by the Atikokan co-ordinator was invaluable, especially when compared to other monitoring programs for which they were unable to find someone with his credibility and qualifications. In the Keephills case, local involvement in data collection is a given. Community members participate in:

- survey design: the three surveys conducted at Keephills had input from both the company and community, although the consultants constructed them and did the interviewing;

- survey response: data were collected only from residents or former residents;

- participant observation (still the major method used): residents bring issues to the Committee on Keephills

Environment (COKE, the community spokesman), and the Keephills Power Project Steering Committee (representing the community, TransAlta, the county and provincial government).

Conclusion: Major issues in data collection include access, timeliness, and expertise. Access is particularly problematic in prediction monitoring because of the lack of incentive to share data. Timeliness is important in impact management monitoring because of the need for a highly responsive data collection and analysis system to serve the user. While opinion is divided on the merits of involving local residents, we support local involvement in all phases of monitoring as a matter of principle.

The literature seldom mentions data analysis, except to acknowledge that it occurs. From reading several monitoring reports, we conclude that the results of data analysis tend to be largely descriptive presentations in a contextual vacuum. It seems that such presentations are meant to take the place of data interpretation and as such are grossly inadequate.

INTERPRETATION

Concerns about the interpretation of data and assessment of their significance are paramount in impact assessment and remain the biggest methodological obstacle. The naive view of change as deviation has been challenged. There are instances where deviation is part of the "normal state of things" (for example, seasonal variation); and where lack of deviation indicates significant change (such as a straight line on a heart monitor).

Two types of problem in the interpretation of change are the appearance of changes that occur within the situation under study, which may or may not be change and which may or may not be significant; and changes that occur, compared to those that would have occurred had the project not been built.

With the first problem type, even distinguishing project-related change in the "with project" case is difficult. As Kopas (1980: 4) states: "Distinguishing an impact from some other social and economic phenomena is a major responsibility of the impact monitoring program, although this is not always possible. ... It is a matter of judgment." In fact, in every monitoring situation there are many factors and projects, in addition to the one studied, which influence the situation. Each of our case studies illustrates this point:

- At Keephills, the community and region had already experienced prior impact from an earlier power plant, yet the Keephills project was treated as if it were a single event for purposes of the SIA. The power plant was planned and constructed during the energy boom of the 1970s. The proposed expansion, however, was caught in a changing environment: first, the City of Edmonton wanted its own power plant and was in competition with TransAlta to see whose plant would be built first; second, the recession of 1981-82 dramatically reduced projected power needs, putting TransAlta's proposal on hold indefinitely. Each of these events affected the timeline and magnitude of the impact.
- At Atikokan, the largest employers were two mines. The SIA Statement assumed that they would remain so and that the Ontario Hydro station would diversify the economy. Instead, both mines closed. Ontario Hydro has been unable to precisely state its effect on Atikokan in this situation, although obviously it is now the largest employer.
- With AOSERP, boom conditions in the oil sands meant it was practically impossible to isolate the effects of any one project from the others. AOSERP was initiated when Suncor had been operational for eight years and Syncrude was already under construction, thus baseline data was impossible to get.

With the second problem type, comparing "with project" to "without project" changes, the standard scientific solution, the use of a control group, has not been used in Canadian SIA monitoring. In the United States, Battelle has proposed the use of control communities in monitoring programs for nuclear repositories. This is certainly a step in the right direction, although some practitioners suggest it is not feasible. NOVA's use of single-shot, multiple-case monitoring is another way to assess change more objectively. NOVA monitored eight pipelines during pre-construction and at peak construction, all in the course of one year (Giles 1985).

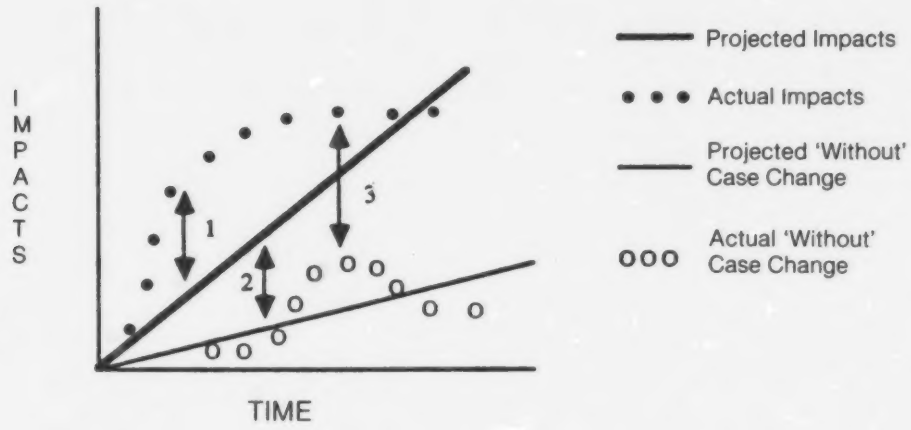
Conceptually it is the comparison of "with project" and "without project" cases that is the focus of impact assessment. However, monitoring as practised focuses on the former, the "with project" case, with no reference to the "without" case, as shown in Figure 3. If the "without" case is considered at all during monitoring, the tendency is to assume that it is a straight extrapolation of the past.

Conclusion: The measurement and assessment of change remain the biggest methodological obstacles in monitoring.

Given a situation where no one can say with certainty whether change has occurred, and more specifically the degree to which the alleged change is project-related, SIA monitoring is on shaky ground if it relies solely on data generation. The SIA literature is silent on how to determine significance in the face of this uncertainty. However, practitioners involved in our cases emphasize that consensual validation of change and its significance, that is, negotiation of data interpretation by the parties-at-interest, is essential.

Even if change is noted and attributable, what is its significance? In the impact management monitoring literature some criteria are given for judging significance:

- May we do something about it? (an issue of mandate or jurisdiction)
- Can we do something about it? (an issue of what is possible)
- Will doing something about it make a difference, preferably in the positive direction? (an issue of what is under one's control).



1. What Monitoring Measures
2. What Monitoring Promises to Measure
3. What Impact Assessment says Monitoring Should Measure

Figure 3. Problems With Interpreting Change

FEEDBACK OF RESULTS

The feedback step is summarily mentioned in the SIA literature. The implication of feedback is that the results will be useful and therefore be used. Two matters are at issue: What is useful information? What is use?

What is Useful Information?

The social aspect of this question is obvious: For whom is it useful? Since aspects of the same data bank may be useful to diverse parties, each requiring certain levels and types of information, a properly managed scoping process lays the foundation for generating useful data. In other words, the customized translation of data to address the needs of each party results in useful information. Leistritz and Chase (1981) have addressed the issue of making results useable for decision makers in impact management monitoring, stating that reporting format may vary with the nature of the situation. In terms of format they suggest:

- the translation of data and analyses into a series of concise, decision- oriented reports;
- the display of information to reflect changes at the level of individual jurisdictions (see also Davidson (1984) regarding the need to clarify jurisdictional responsibility);
- the display of information so as to make easy comparisons between a present use and capacity, and between its present and predicted use;
- the use of information that is compatible with existing administrative procedures of the affected entities whenever possible; and
- an information system that can be updated easily, at user request.

Conclusion: User-friendly reporting procedures are essential. They must meet user needs, as the user sees them.

The timing and display of user-oriented information has not been addressed in terms of other monitoring types, except in passing. For example, Fookes produced a double report series for the Huntly Monitoring Project — several reports for a general audience and several for a technical audience — on the grounds that these audiences have different interests and needs. The literature assumes that more esoteric monitoring approaches will rely on publication in scholarly journals. Some monitoring programs use community newsletters or newspaper articles as dissemination vehicles, although there is repeated evidence that written communication is ineffective as a medium for technology transfer (see Roberts and Frohman 1978).

In our case studies, feedback of results was accomplished in different ways. AOSERP took as its primary audience scientists and bureaucrats in government and industry, and produced scientific reports. This was a logical consequence of the program objectives being directed to the needs of the resource-managing or human service departments of government. In Keephills, transfer and use of knowledge occurred through frequent meetings of COKE and the Steering Committee, and the use of an extensive communication network. The survey results were distributed to each resident who participated. In Atikokan, the primary written document is the annual report. However, most feedback between the Township and Ontario Hydro is by telephone or face-to-face discussion.

What is Use?

The immediacy of use is more at issue in impact management monitoring than in prediction monitoring. Porter (in Fookes *et al.* 1981:30) explains the difference: "Monitoring can contribute to long-term improvements in project planning or in knowledge for future impact assessment. However, rarely are project experiences repeated with similar expenditure or workforce characteristics and similar host communities. In most cases, therefore, *the knowledge gained [from prediction monitoring] is contingent and of inferential, rather than direct, value. The potential for monitoring to assist in short-term management or impact mitigation therefore provides its immediate and most compelling justification.* [Impact management] monitoring holds the promise of better enabling a community to respond to and accommodate the consequences of project-related changes" (italics ours).

Conclusion: The meaning of use varies with monitoring type.

Concerns about immediate, direct use assume that the direct application of results from a specific study to a pending decision constitutes their best use. This type of knowledge use requires extraordinary conditions: "a well-defined decision situation, a set of policy actors who have responsibility and jurisdiction for making the decision, an issue whose resolution depends at least to some extent on *information*, identification of the requisite informational need, research that provides the information in terms that match the circumstances within which choices will be made, research findings that are clear-cut, unambiguous, firmly supported, and powerful, that reach decision makers at the time they are wrestling with the issues, that are comprehensible and understood, and that do not run counter to strong political interests" (Weiss 1979:428). These are the conditions that Halstead and his colleagues (1984) feel are necessary for successful impact management monitoring.

However, Weiss and Weiss (1981) suggest that immediate, direct use is too narrow a definition of knowledge use, especially if the intended user is "the decision maker." Other types of use include "bringing new ideas to public attention, framing or conceptualizing problems, keeping up with professional developments, finding out what is happening in other [jurisdictions] . . . , legitimating budget allocations, attacking established policies, or lobbying for new programs. Research need not be practical, explicit, feasible, and noncontroversial to be useful in these ways" (Weiss and Weiss 1981:846).

Conclusion: Successful use is not always direct and immediate.

CHARACTERISTICS OF A PROPERLY DEVELOPED MONITORING PLAN

Our review of the literature and discussions with practitioners suggest that properly developed monitoring plans share two characteristics: they are simple yet complex, and they are practical. Each characteristic is discussed in turn.

Simplicity/Complexity

The idea that monitoring should be both simple and complex is a common theme in the SIA monitoring literature. On the surface, it presents a double bind: on the one hand the need to be totally comprehensive, and on the other hand the need to narrow down, for fear of drowning in the data.

Examples from both ends of the spectrum — comprehensive and single-variable SIA monitoring — are available.

Comprehensive programs include Revelstoke, Huntly, the Ontario Hydro program described by Walker (1979), and the 79 potential indicators for the Beaufort (Carley 1984; Rolf 1985a). They tend to use one of two approaches: "Information Sponge" or "Rolling Target" (see Proctor and Redfern Group 1979).

The "Information Sponge" approach soaks up information like a sponge soaks up water. This approach has been used at Revelstoke and Huntly. It has three strengths. First, its implementation is easy to understand. Second, it can be implemented without much preparation. Third, it is very useful in situations where the objectives are unclear, because it allows for the monitoring of impacts without a clear idea of what is intended to be achieved. Considering the degree of conflict over study design that is endemic to exercises with multiple parties-at-interest, it is easy to see how this can be viewed as a strength. In summary, it appears to meet the criterion of comprehensiveness in a pragmatic way.

The major drawback is that it is hard to know what to collect because anything could be relevant; no boundaries exist. The amount of data that is collected tends to be overwhelming and unmanageable, yielding little information. In short, this approach is far from simple.

"Rolling Target" is another potentially comprehensive approach. It is based on a model against which targets are set and forecasts revised. The major drawbacks are the expense and time required to develop and test the model, especially if it is a sophisticated computer model. Leistritz *et al.* (1980) suggest a cost of several hundred thousand dollars ($US) as appropriate for regional model development, excluding background data collection and analysis. Inherent in computer modelling is the temptation to be fully comprehensive and so complex that the model is impractical. From extensive

experience in modelling and in working with decision makers, Murdock and his colleagues conclude that in the case of impact management monitoring, for which sophisticated models are used and forecasts are generated frequently, comprehensive simplicity is essential.

At the opposite end of the spectrum is the single-variable monitoring approach, practised by Ontario Hydro at Wesleyville, by Freudenberg (1976) in testing the predictive capability of SIA Statements, and by NOVA's single-shot, multiple-case monitoring of pipelines at peak impact (Giles 1985). These are examples of the "Target Tracking" approach, where a target is based on an objective, plan, policy, hypothesis, or a prediction in an SIA Statement. This target is tracked and deviations from it are identified. Compared to "Information Sponge," this approach is more focused and has a standard against which data can be measured, but it is less dynamic than the "Rolling Target" approach.

A major drawback to "Target Tracking" is its tendency to treat its variables as single entities, rather than as interrelated; hence a naive view of change and its attribution. This is changing in the ecological sciences, but requires a systemic framework and a larger infusion of capital, sometimes even greater than for "Rolling Target" (see, for example, Legge 1982).

Conclusion: Because the situation being monitored is so complex, an effective monitoring plan uses the fewest key variables while retaining a sense of the whole and its complexity.

Practicality

The role of administrative criteria, such as data access, timeliness, and cost, in enhancing the practicality of monitoring tends to be ignored. In our experience, administrative criteria tend to be frowned upon by those SIA researchers who prefer normative lists or models. They prefer to aim for the potentially possible, rather than for what can be realistically achieved. SIA practitioners have the opposite tendency. They argue that, when selecting variables and indicators, data accessibility, timeliness, cost and ease of analysis are as important to consider as a model or normative shopping list. Obviously it is useless to plan monitoring around data that are not accessible, or whose retrieval costs exceed the budget. Sometimes, the reconciliation of administrative and methodological criteria is not addressed in a satisfactory way, as shown by the data access difficulties with the monitoring program for the Norman Wells pipeline (Bone 1984b). The study team intended to obtain more detailed information from the communities than in the normal survey. For this purpose they designed a very detailed questionnaire to be answered by a select number of residents in several communities. The questionnaire was so long and complex that only five of the 25 people who were approached participated in the survey. This in-depth segment of the monitoring program was then discontinued. In other words, the survey was important methodologically but not feasible to implement "on the ground."

Conclusion: An effective monitoring plan is practical, that is, it can be implemented in the "real world" within the constraints of the situation.

CHAPTER 3: THE MANAGEMENT PROCESS

INTRODUCTION

In the previous chapter we outlined a four-step monitoring plan: scoping, collection and analysis, interpretation, and feedback of results. This model bears a recognizable relationship to the SIA and EIA processes. It is a logical way to describe the steps taken in monitoring *after* they have been completed. However, we should not mistake this model for reality, and assume that monitoring actually happens in a linear, logical fashion. In our experience and in discussions with monitoring professionals, this is far from the case. What is usually described is a seemingly convoluted, chaotic, and messy process which many professionals feel cannot be revealed in publications or presentations for fear of criticism. It is seldom realized that this is monitoring as it happens, and that this must be understood in order to appreciate and learn from the process as it unfolds in real time.

In this chapter we focus on the management process in monitoring. This management process is not explained in the SIA monitoring literature. In our opinion, it is essentially a social process involving the management of groups. The SIA literature is silent on many of the human problems involved in groups, such as conflict due to different assumptions and values, or leadership crises, or difficulties with motivation and morale, leading to turnover. Anecdotal evidence, which has tended to be viewed as case-specific, rather than generic, is an exception to this. Therefore, we rely largely on the group process and management literature for this chapter.

The model we present here is based on the problem-solving literature, particularly the work of Kolb (1976). We chose it because of its ability to handle the complex, ambiguous, and value-laden problem situations which characterize SIA monitoring.

The model assumes that the concurrent management tasks of problem solving are:

- ensuring that the process of analysis is orderly and systematic;
- developing the proper organizational arrangement, in order to promote co-operation among interdependent units or agencies; and
- ensuring the appropriate involvement and participation of the parties-at-interest, by managing the relationships. This means using conflict constructively, for information sharing and collaborative problem solving (see Kolb *et al.* 1984:152).

Each of these is discussed in the following sections.

ENSURING THAT THE PROCESS OF ANALYSIS IS ORDERLY AND SYSTEMATIC

The model assumes that the process of analysis is essentially a social one, requiring the use of different problem-solving styles in sequence. The process of using these problem-solving styles is not logical and linear. It is a series of pulses, consisting of expansions which move outward to gather and consider alternatives, information, and ideas, and contractions which move inward to focus, evaluate, and decide (Carlsson *et al.* 1984). Each expansion-contraction pulse forms a stage:

- Stage 1: Situation Analysis
- Stage 2: Problem Analysis
- Stage 3: Solution Analysis
- Stage 4: Implementation Analysis

Each stage is described below (based on Kolb *et al.* 1984:152-160) using examples from our case studies. A complete analysis of a single case is inappropriate because no case consciously used the model and much of the necessary data for such an analysis is incomplete. The closest of our three cases to this model is the Keephills case. We believe that this is so because the consultants involved used process management techniques, and the key participant from the company also has such skills.

Stage 1: Situation Analysis

The key task of the first stage is to transform the problem as it is given to the group, to the problem as chosen. In the Keephills' case, the problem as stated by the Government of Alberta to TransAlta was: TransAlta cannot locate at Dodds-Roundhill, and must find another locations as soon as possible. TransAlta's chosen problem was: We know that finding another site is not difficult but getting local acceptance of it is and can intervene in our plans at the highest level. Our problem is to find another approach to the community, one that will prevent community opposition to our project. The problem as chosen — finding a process that would prevent community opposition — formed the basis of the actual objectives to which the process was oriented, although these objectives, as such, were never articulated.

This transformation of the problem is an intuitive process of trial and error. It requires a creative problem-solving style that can generate alternatives. The trial and error nature of this stage is best illustrated in the Keephills case, where senior management in the company looked at various alternatives to a public relations approach that had failed. A happenstance meeting between a sociologist and a senior TransAlta official

resulted in the approach taken. Other appropriate methods might include brainstorming and browsing through the literature.

The expansion part of this stage focuses on valuing: exploring the full range of problems and opportunities to create a menu of desired end-states. The contraction part of this stage focuses on selecting priorities: choosing the "right" problem based on urgency and importance. This includes looking for aspects of the situation which serve as facilitators or inhibitors, testing how feasible it is to change them, and developing goal statements.

ASSOCIATED PROCESS ISSUES

The first stage requires a supportive and secure process environment. Because this stage is value-laden, conflict among participants is likely to arise. This conflict is often interpreted as a personality clash; more likely it is a values clash. The typical reactions will be fighting, withdrawal from the process, or isolation, that is, self-imposed withdrawal while remaining physically present, and/or being ignored by others in the group, i.e., ostracism.

Stage 2: Problem Analysis

The key task of the problem analysis stage is to understand the problem by defining the essential variables that influence it. Because these variables must be managed to solve the problem, this is the precursor to developing a solution. The problem-solving style needed at this stage requires planning and theory development abilities, and the use of techniques such as data management or game theory. This is a stage where monitoring programs get "bogged down," often because of an inability to generate an adequate model. For example, in AOSERP, the use of a computer model for the human system, during the Adaptive Environmental Assessment Process, proved to be problematic. The model could not fully encompass the data collected and there were concerns about its lack of receptivity to important data and types of information, particularly qualitative information. Moreover, according to some, the model drove the process, that is, people had to fit into it, rather than the reverse.

The expansion part of this stage deals with gathering information. It is important to collect data without editing: the data should speak for themselves. The contraction part of this stage deals with problem definition, using information gathered in the expansion to construct a model. The problem is defined based on the information gathered. This requires two skills: causal analysis and imagery. One creates a mental model of how the problem occurs; the model is then subjected to various transformations. In this way an understanding of how the model operates and how the problem might be solved unfolds.

ASSOCIATED PROCESS ISSUES

In this stage important process issues are receptiveness to and open-mindedness about the various types of information. Trust among all parties concerned is essential because the process can be very threatening.

Stage 3: Solution Analysis

The third stage concentrates on choosing the most appropriate solution to the problem. Hence the need for a problem-solving style emphasizing decision making, for example, through the use of decision trees or experiments. As an example of this stage, we return to one of the chosen problems in the Keephills case, that is, finding a way to preserve the community in the face of strip mining in the immediate area. At a public meeting the consensus was to solve the problem by moving the hamlet of Keephills, thereby preserving community cohesion. It was the best solution to the problem. Fortunately, a senior manager of the company was present and was able to make the decision on behalf of the company "on the spot."

The expansion part of this stage deals with generating ideas for possible solutions, often by brainstorming. The contraction part of this stage deals with decision making by testing the feasibility of the solutions generated above.

ASSOCIATED PROCESS ISSUES

Creating a supportive atmosphere, which, during expansion, is free of evaluation, is important at this stage.

Stage 4: Implementation Analysis

In this stage, tasks are organized into a coherent plan with timelines, follow-up and evaluation. This includes the participation of those who will be directly affected by the situation, but may have not already been involved in the problem-solving activity. Hence, the need for a problem-solving style oriented toward accomplishment, perhaps using critical path management or goal setting. An example of the highly participative nature of implementation analysis is taken from the Keephills case, concerning "the negotiation of principles and guidelines for the relocation of the community residents. TransAlta drafted a position paper on this subject matter which expressed the company's perspective. COKE in turn drafted the community's position paper, which had a very different view. This process was repeated five times as each participant did not respond directly to the other's position paper but instead to their specific interpretation of it. The fifth and final draft was acceptable to both TransAlta and COKE" (Prokop 1983:9).

The expansion part of this stage focuses on involving those who will experience the consequences of implementing a solution to the problem. The contraction part of this stage deals with finding key individuals who have the expertise and/or motivation to do the tasks well, then developing detailed plans around their strengths. This is the reverse order of many preferred management styles, but recognizes resource scarcity — too few good people to do the job.

ASSOCIATED PROCESS ISSUES

Key process issues are participation through inclusion and receptivity or openess to the concerns and ideas expressed.

At this point, individuals who were involved in earlier stages of the problem-solving process may have to be involved again, since the situation and perceptions of it may have changed, thus warranting further analysis. The whole process may eventually go through a number of cycles of the four stages.

Conclusion: In our opinion, effective monitoring is an exercise in iterative problem solving. It involves integrating opposed mental orientations — expansion and contraction mind sets. The expansion phase facilitates creative imagination, sensitivity to the immediate situation, and empathy for others. The contraction phase facilitates analysis, criticism, logical thinking and active coping with the external environment (see Kolb *et al.* 1984:155).

DEVELOPING THE PROPER ORGANIZATIONAL ARRANGEMENT

The second of the concurrent management tasks is to develop the proper organizational arrangement to promote co-operation among interdependent units or agencies.

The monitoring literature in general does not give recipes for successful structural design, that is, ways of formally organizing the reporting relationships and responsibilities of the parties-at-interest. In practice, few organizations consider the ramifications of structural design. Group design has tended to be structured in two ways: random assignment on the basis of individual expertise, for example, a monitoring organization composed of social scientists of varying disciplines; or some combination of individual expertise and vested interest, such as social scientists with some structural relationship to special interest groups and local authorities. The management literature suggests that these are insufficient bases of group design because they pay no attention to task and people preference, thinking styles or the nature of the problems to be addressed, all essential factors in addressing complex problems (MacDonald 1982b).

This lack of fit plagued at least two monitoring programs, Revelstoke and REAP (Regional Environmental Assessment Program) in North Dakota. Davidson (1984) believes the structural placement of the monitor is important and cites poor placement as a reason for the failure at Revelstoke. Leistritz *et al.* (1980) concur, suggesting REAP was terminated because of prolonged arguments about its structural placement.

One article does dwell on the importance of relating the structure to the monitoring environment or situation. Based on his experiences with the Keephills case, and as a consultant to various corporations, Goldenberg (1984) suggests that consultative monitoring exercises, in which public participation is fundamental, are essentially complex and are usually conducted in turbulence. As a result, he recommends an organic structure. The term *organic* is taken from Burns and Stalker (1961). They characterize organizational structure as ranging along a continuum from mechanistic to organic, as shown in Table 3. At one end of the spectrum is the mechanistic organization, the stereotypic bureaucracy. At the other end is the organic organization, often shown in studies of corporate excellence, especially by high technology firms. Neither is better than the other. What Burns and Stalker suggest is that the organizational structure must fit or be appropriate to the degree of stability in the external environment or to the situation in which the organization exists. The more dynamic or unstable the environment or situation is, the more appropriate an organic structure becomes.

What Goldenberg argues is that TransAlta's "organic" nature enabled it to respond effectively to the Keephills situation, where other organizations could not. Prokop (1983:6) a TransAlta employee highly involved in the Keephills case concurs: "The proponent must take an active role in the process. . . . Senior officials of the developer must have personal contact with the community to accurately represent the proponent's perspective and to modify that perspective through the public participation process. . . . When conflict arises, the proponent must be able to respond quickly, flexibly and responsibly to community inputs." The argument for organic organizational structure is compelling, considering the turbulent situations in our three case studies.

According to management principles, the structure must fit the domain or management situation in which it is housed, both in terms of the external situation and the internal norms and rules. For many agencies this is a double bind: staff must be responsive but are housed in bureaucracies whose rules and regulations thwart any attempt at innovation and responsiveness. For example, monitoring conducted under the auspices of a government agency must conform to certain administrative standards, such as specified salary ranges, even if the most expert personnel are excluded, as a result. Advisory committees under such auspices must fulfill ritualistic obligations: such committees cannot have a deputy minister represent one department while a branch head represents another, even if these are the most appropriate representatives. In such cases, either creative alternatives need to be looked at, or the lack of fit between what must be accomplished and the structure to do so will remain.

Conclusion: Based on our experience and a review of the management literature, we believe that several management principles must be considered in developing an appropriate organizational arrangement:

- **responsibility must match authority;**
- **the structure must recognize interdependencies, within and without the host organization;**
- **the responsibilities assigned to the monitoring organization should match its informational, technical, and financial resources (Krawetz 1981c; Leistritz *et al.* 1982), i.e., there must be an opportunity to perform;**
- **continuity of professional and technical support is essential and/or a strategy to deal with discontinuity and turnover is needed (Leistritz *et al.* 1982);**
- **the design must fulfill ritualistic obligations.**

Because the nature of the external situation may be at odds with an organization's structure, and the structure

Table 3
Some Comparisons Between Mechanistic and Organic Organizations

MECHANISTIC	ORGANIC
Tasks are: — divided into components and specialized — not clearly related to organizational objectives — rigid	Tasks are: — interdependent — clearly related to organizational objectives — continually adjusted
Roles are specific	Roles are generalized
Hierarchic structure	Network structure
Information rests at the top	Knowledge centres are throughout the organization
Communication is vertical	Communication is vertical and horizontal
Loyalty and obedience highly valued	Commitment to goals highly valued
Best suited to static contexts	Best suited to dynamic contexts

Based on Burns and Stalker (1961).

may be entrenched, the most effective organizational arrangement may not be able to develop. In our opinion, many monitoring attempts fail because the host organization's structure is incompatible with the situation SIA monitoring is embedded in.

ENSURING APPROPRIATE INVOLVEMENT OF PARTIES-AT-INTEREST

Process management is necessary to ensure the appropriate involvement and participation of the parties-at-interest. Conflict should be used constructively, for information sharing and collaborative problem solving. While this appears to be relatively straightforward, here lies SIA/EIA monitoring's greatest weakness, for the skills required for process management are not recognized and thus not actively incorporated into the monitoring team. Dorcey and Martin (1985) confirm this.

Three issues arise in process management which must be addressed for effective problem solving:

- inclusion, meaning that relevant parties are invited to participate, and are physically present or aware of the activity;
- receptivity, referring to process management that creates an atmosphere of trust and allows all participants to express their views without fear of reprisal or derision; and
- commitment, meaning an agreement to do something.

The Issue of Inclusion

WHO IS INCLUDED?

In the normative sense, every affected or potentially affected party-at-interest has the right to be involved in monitoring. Such involvement should result in a monitoring program that incorporates all the different points of view meaningfully and in a way that is practical. This is "impact assessment motherhood." It has led to the formation of advisory committees, public hearings, and other forms of consultation, many of which are only nominally integrated into the decision process.

In our opinion, because the situation being monitored is complex, many parties are potentially affected. In impact management monitoring, for example, a lack of response by one party can affect the ability of another to respond. In other words, without the concurrence of all affected parties nothing can be done. For these reasons, we conclude that many parties-at-interest must be involved in the monitoring process.

The roles these parties-at-interest can play include:

- the sponsor(s)
- the monitor(s)
- the object-of-study
- the observers
- the contributers
- the users.

The sponsor(s) are those who fund monitoring and whose role ranges from "no strings attached fundor" to highly directive clients. Three types of fundors are: proponents, regulatory agencies, and/or communities. The literature does not differentiate between private and public sector proponents.

Several practitioners suggest that proponent sponsors are more efficient and likely more capable of providing clear objectives, because of the task-oriented and often project-specific nature of their SIA monitoring needs. They feel that

regulatory agency-sponsored monitoring programs are less results-oriented and more diffuse than proponent-sponsored monitoring — mirroring the complexity of the public service. In their opinion, an already complex situation is made even more so when various aspects of hierarchy, jurisdictional mandate and inertia must be considered. The administrative arrangements of the public sector — the difficulties of developing workable, interdepartmental co-operative efforts — are not sufficiently task-oriented to engender confidence amongst some practitioners, especially when a task force must take action quickly. This is not necessarily a fair assessment, since bureaucracy is not the monopoly of the civil service, but rather a characteristic of a mechanistic organization.

Essentially the basis of concern is with the difference between the private sector's focus on efficiency — concurrent maximization of output and minimization of input in order to get the most results with the least resources; and the public sector's concern with public accountability — the way in which things are done — as outlined by Bower (1983).

Bower suggests that this difference is fundamental and is the reason why the management principles of the private sector do not apply to the public sector. When practitioners say that proponents, particularly private sector ones, are more responsive, they usually cite increased efficiency. This is due to managerial influence largely through two enabling devices: changes in organizational structure and changes in human resources to produce results. Furthermore, such results can be rewarded by perks, such as profit sharing. These enabling devices are constraints in the public sector, for organizational structure is often set in legislation and the civil service system protects employees from management control. Moreover, if civil servants reward themselves with a share in the profits, they are jailed. In summary, we believe some basic differences exist in private and public sector sponsorship because of fundamental differences between the two sectors.

There have been community-sponsored or special-interest monitoring programs. One example is the record of sour gas related impacts kept by local residents near sour gas plants in Alberta, often over decades. In the courts, such records have been discounted on the grounds that methodological expertise and objectivity were lacking. However, the Alberta government does keep records of locally reported health and agricultural impacts, especially during blowouts, as guidance for future research. In fact, the health symptoms reported during the Lodgepole, Alberta, blowout of 1982 are the basis for the new hydrogen sulphide emission evacuation criteria for sensitive individuals. The fact that such efforts lead to action suggests that community-sponsored or special-interest monitoring can be very effective.

In our experience, the community or special interest group must rely on volunteers, the goodwill of technical experts to provide advice at lower cost, and a "shoestring" budget. We believe the major difficulty with community-sponsored monitoring is its inherent lack of resources, compared to private or public sector sponsorship.

A summary of sponsorship issues, such as the focus of monitoring, its benefits and its costs, is shown in Table 4, and is based on our experience and the management literature.

In terms of focus, each sponsor has an interest in concentrating on a specific area. The proponent's preference tends to be on project-specific issues, sometimes to the point of focusing solely on those areas where proponent action can influence the nature or magnitude of an impact. An example is the comparatively narrow scope of NOVA's monitoring program for eight pipelines (Giles 1985), described in the previous chapter and shown in Table 2. A government-sponsored monitoring program may prefer to focus on an overall program responsibility area, for example, ways in which a particular project affects a program providing native housing. Community-sponsored monitoring tends to be directed toward the way in which a project(s) affects that community. This may be quite different in scope than monitoring by proponent or government, as shown in the scope of the Keephills case in Table 2, compared to the other examples on the Table.

The benefit of a proponent-oriented program can be efficiency — an approach based on a relatively narrow definition of the factors to be considered. An excellent example is Ontario Hydro's monitoring at Wesleyville, which consisted solely of a Hydro workforce survey, dealing with worker characteristics. The benefit of a government-oriented program can be accountability — monitoring will be conducted within the rules and norms of administration. For example, if there is a government policy of affirmative action, care will be taken not only to produce monitoring results but to ensure these results are produced by employing minorities, as much as possible. The benefit of community-sponsored monitoring can be its basis in the reality of community interests, which, otherwise, in our experience, are not well represented.

Each type of sponsorship exacts its particular costs. A proponent sponsor may not want to monitor factors beyond a narrowly defined project mandate, for fear that identifying a problem will raise expectations that the proponent will solve it, regardless of the jurisdiction in which the problem exists. A government sponsor may not be able to provide the highly responsive system required for impact management monitoring because the need for accountability may extend the time lines. Community sponsors may not have the money and/or volunteer time and volunteer expertise to carry out defensible monitoring.

Conclusion: Resource support can come from a variety of sources, each having benefits and costs. In our opinion, none is necessarily more effective than the other.

A monitor is an individual or organization who administers and undertakes monitoring. The monitor has two functions: an administrative function, which includes office management, coordination and public relations; and a research function, which includes theory, design and data collection (Kopas 1980). From personal communication, we gather that monitors consistently underestimate the amount of time required for the administrative function. Lack of clarity of monitoring objectives, as well as attempts to handle the dual load of administration and research, are stressful and lead to personnel turnover.

The monitor may be an individual or organization: consultant, in-house staff of an organization or the community, and/or

Table 4
Sponsorship Issues

	PROPONENT **Public or private**	**GOVERNMENT**	**COMMUNITY**
FOCUS	Basic orientation to specific project or class of projects and factors amenable to proponent influence	Basic orientation to specific project (if proponent) or overall program responsibility	Basic orientation to specific project or project series as it effects the community
BENEFIT	Results-oriented; most likely to target areas of specific concern	Accountable; emphasis on how things are done	Grounded in community interest
COST	May refuse to identify issues beyond mandate, for fear that remedial action will be expected	Difficulty in responsiveness, given need for accountability, leading to problems with impact management	Lack of money, time, and expertise may result in a program that is not defensible

academics. A summary of the literature on each is described in turn.

We have found one recommendation in the literature on the role of consultant monitors. "The proponent should hire a social consultant that will take an active role in the public participation process . . . The [consultant's] role is to consult with the community . . ., evaluating the assessments, perceptions and opinions of the local residents" (Prokop 1983:6). Pattenaude and Landis (1979) suggest that consultants are the major vehicle for information transfer across projects, since most of the literature is not easily accessible, and many sponsors do not have sufficent in-house resources. For example, in its latter years, AOSERP used consultants and academics almost exclusively, and its in-house staff focused on contract management. This type of arrangement is successful if appropriate resources are available in the consulting community and if competent research management skills exist in-house.

Leistritz *et al.* (1984) suggest that for successful impact management monitoring the monitor should be an individual or group within the project developer's organization, with specific responsibility for implementation. Ontario Hydro, for example, uses in-house staff in combination, where possible, with community members.

Krawetz and MacDonald (1982) suggest that traditionally structured universities are not well suited to SIA monitoring projects on a contract basis because of the need for interdisciplinary collaboration, the lack of reward for contract research, and the tension in the issue of where academic freedom ends and responsibility to the client begins. Their suggestion is based on a review of the Huntly Monitoring Project and a review of the interdisciplinary research literature. However, in the Keephills case, the consultants were full-time academics in one department and had worked together for several years. They stressed that they could not have played this role if they had not been fully employed academics: having a guaranteed income removed them from client influence and allowed them to operate on their own terms. They feel that if they had relied on consulting as a sole source of income, they would have felt more obligated to please the client and not as free to walk away from the monitoring if it was not being conducted according to their standards.

Davidson (1984) suggests that the monitor be a qualified person, preferably a local person familiar with the community. What does being qualified mean? There are three aspects : someone who has the methodological expertise to carry out monitoring; someone who has knowledge of the study area, though not necessarily a resident; and someone who has research credibility and local respect. In none of the case studies were all three criteria met. An example of a qualified locally based monitoring co-ordinator is Syd Hancock, who served the Township of Atikokan in its joint monitoring with Ontario Hydro. According to Ontario Hydro staff, Hancock's best skills are extensive local knowledge based on long-term residency in the area and serving on Township Council (particularly important since the monitoring was based on an Agreement between Ontario Hydro and the local authority); local credibility based on his past experience; and the ability to encourage local agencies to co-operate in data access, based on his credibility and personal relationships with their representatives. Hancock is a surveyor by training, which, coupled with his local authority experience, gave him a background in data collection. Hydro staff played a major role in data analysis and interpretation. In the Keephills case, all residents acted as participant/observer monitors, channelling their data to COKE and the Steering Committee. Combined with the surveys and the way the process was managed, this type of high involvement, community-based monitoring is very effective.

Durlak and Morgenstern (1977:34) list characteristics that monitors we have talked with agree are essential to survival: a willingness to enter into a process of mutual education with the

parties-at-interest; a willingness to embrace uncertainty; a willingness to subordinate methodology to study results of practical significance; a willingness to stand by intuitive judgments; a willingness to sell new methodologies; and a willingness to mediate in conflict among actors. In addition, they agree on the needs for patience, persistence and diplomacy — superb process management skills.

Conclusion: Essential qualifications for monitors are research credibility, local respect, and process management skills.

The object-of-study, in SIA monitoring, is the study area or the population in the community. There is considerable role confusion about the object-of-study, for two reasons. First, exactly who or what the community or study area is, is open to debate. In fact, its boundary can change throughout the course of the monitoring. Second, in SIA the object-of-study has a directly noticeable influence over the course of the monitoring results, compared to biophysical monitoring; no one ever worries about whether to invite members of the local muskrat population to sit on a committee for research design, and muskrats have not been known to write to the Cabinet if monitoring is not being conducted to their satisfaction. Ideas about whether or not the community's role should be limited to that of the object-of-study relate largely to the two dominant paradigms in SIA, the technical and the sociopolitical (Lang and Armour 1981); these paradigms are described further in Chapter 6. In the technical paradigm, a local authority, a legally recognized entity, plays a role in sponsorship and/or monitoring, with the rest of the community playing the role of the object-of-study. The sociopolitical paradigm infers that the various groups, including the community and special interest advocates, which may be the most sensitive to impact, become the sponsors, monitors and objects-of-study, so that power is shared (see Fookes *et al.* 1981).

Members of the community may participate in defining the scope of the monitoring and in data gathering (Dixon 1978). In some cases citizen advisory committees are used (Davidson 1984). Sometimes a local resident gathers and analyses data defined by another party.

Conclusion: The role of the community varies and is often split between those who study and those being studied.

The observers are those who are ritualistically required to watch but do not necessarily actively participate. Many parties are given the role of observers while not actively participating in the design and execution of the monitoring exercise itself. An example is the Keephills Steering Committee, established by order-in-council, through which COKE and TransAlta reported their issues and decisions. In many cases, according to TransAlta and its consultants, the government members of the Committee took notes and reported to their respective agencies, but took no action. Other than noting that this role exists, there is no information in the literature.

The contributors are those from whom information is required, but who do not necessarily receive direct benefit from participating. For example, in the Ontario Hydro case, data were required from several locally based provincial agencies, yet the Agreement excluded these agencies from access to any compensation monies. Under these circumstances, agencies need motivation to continue providing data over time, according to the monitoring co-ordinator.

Conclusion: If contributors do not benefit directly from providing data for the monitoring program, motivation becomes an issue.

The user(s) of the monitoring results may include the public at large, community groups, policy makers, government planners, project proponents or developers, academics and SIA professionals.

Only in impact management monitoring is the user's role explicitly defined as one who acts on the monitoring data, implementing the necessary management measures, such as compensation and mitigation (Halstead *et al.* 1984). To ensure user-friendliness, Halstead and his colleagues suggest establishing a close partnership between model developers and local data users at the earliest stages, with continued involvement throughout the process, so the needs of both mesh. In other words, use must be front-ended.

The role of the user in other types of monitoring has not been addressed. It seems that the onus is on the user to make the received information useful. However, information is not always used at the time or in the manner envisioned by those who develop it (see Berg 1982; Doern 1981; Hammond *et al.* 1983; O'Hare 1980). This issue has not been addressed in SIA monitoring, other than in personal communications about the disappointment over the potential users seeming refusal to fulfill their role, that is, to make use of the results.

Conclusion: We believe disappointment over the lack of use of monitoring information stems from a lack of familiarity with the literature on knowledge use, specifically on what constitutes useful information and use of information, as described in Chapter 2.

Conclusion: In monitoring, a number of parties-at-interest are involved. Exactly who they are varies with the situation; however, the roles they play do not. Some parties play more than one role. A party's role can vary throughout the process.

ON WHAT BASIS ARE PARTIES INCLUDED?

The major bases on which parties are included seems to be credibility, expertise, and mandate or jurisdiction. This section focuses on credibility since the other two criteria are self-explanatory.

Many authors agree on the importance of maintaining credibility with the community during impact management monitoring exercises (Davidson 1984). Carley and Bustelo (1984) suggest an open monitoring process with a high level of public participation, to maintain public confidence (see also Millard 1985). They state that for public confidence, the impacts monitored must be formally related to methods for mitigation and compensation, otherwise monitoring will be seen as token. These authors are implying that legitimacy — a

stamp of approval from the community — is important. Consultants associated with the Keephills case said that involving the community ensures credibility with regulatory agencies, who look for community involvement when judging the acceptability of a monitoring program. Carley and Bustelo suggest that the public has no interest in academic exercises, that is, monitoring without mitigation and compensation; this implies little if any role for the public in terms of research and development monitoring.

The issue of parity is related to credibility and is usually associated with the notion of community support, whether the support is in terms of funds, involvement in, or passive acceptance of the monitoring exercise. Community involvement presents difficulties in terms of representation, power and resources. In terms of representation, Rolf (1985b:6) states the need "to get the right people to the table and to make sure they are accountable to their constitutents. 'The right people' means that the negotiators are able to commit their constituencies to supporting and implementing the monitoring program, and that some mechanism for accountability exists which may help assuage the problems of imperfect representation." She acknowledges that peer pressure and the politics of personality in small communities may threaten accountability. In terms of power and resources, she states the importance of symmetry of power and resources between the parties, multiple issue agendas, and a mechanism for resolving disputes and achieving accountability that is compatible with local political culture.

The issue of credibility manifests itself mostly when those excluded question the legitimacy of the monitoring exercise, discounting the "findings as irrelevant and a waste of time and money" (Durlak and Morgenstern 1977:28). They believe that they are parties-at-interest but have not been actively considered as such in the monitoring exercise. In some cases, they may be parties who were originally included but withdrew over conflicts in monitoring approach and/or the role they were expected to play. Allowing these parties "to remove themselves from the process of establishing content will not only undermine the study's relevance, but will also place the research directors in a most vulnerable and professionally embarrassing position" (Durlak and Morgenstern 1977:28).

For example, the Dene's exclusion from monitoring programs on the Norman Wells project has been documented (Fee-Yee Consulting Ltd. 1985). In 1982 an intergovernmental biophysical monitoring and research program was set up for the Norman Wells pipeline. In 1984 industry and Dene representatives were added to the program committee, but Dene participation appears to be limited to training in survey and sampling techniques (Boreal Ecology Services 1985). Recent press coverage indicates the Dene are dissatisfied with the role and have discounted the results. The SIA monitoring program sponsored by Indian and Northern Affairs Canada also failed to involve local people.

Much of the discussion on exclusion centres on the community or special-interest groups. In some cases there is considerable reluctance to include the community as a partner in determining study content and method, simply because it is seen to be a "pain in the neck." This reduces the potential for consensus and increases competition for limited resources to study items of interest. Furthermore, it takes considerable time and skill to familiarize community participants with the requirements of a precisely defined research design. Highly politicized community groups may wish to bias the research. "This is a time consuming and expensive exercise that could lead to disagreement and debate, or the introduction of new problems and issues that from the project director's perspective are best ignored. The resistance to become involved in this type of exercise will be particularly strong if the project directors and professional staff do not really understand or accept the value of . . . [such] research in the applied setting" (Durlak and Morgenstern 1977:28; see also Porter in Fookes *et al.* 1981). Yet according to the consultants the inclusion of residents in designing the Keephills surveys was important and facilitated survey conduct. The inclusion of the community and delegation of authority to it is seen by all parties involved as essential to the effectiveness of the Keephills monitoring program.

Conclusion: The complex, interdependent nature of SIA monitoring requires the involvement of many different parties-at-interest if the monitoring is to be effective. The greatest potential for efficient monitoring occurs when the number of parties-at-interest is limited to one or two, as Halstead *et al.* (1984) suggested for impact management monitoring, although it may not necessarily be the most effective in the long term. The greatest potential for effective monitoring involves the entire range of parties, though it is hardly efficient in the short term.

Receptivity

The more parties-at-interest are involved, the greater likelihood for differences in values, usually expressed by conflict or isolation. Unfortunately the personality of scientific professionals is such that they are likely to withdraw in the face of conflict rather than resolve it (see Miller 1984; Van Den Daele and Weingart 1976). Although Durlak and Morgenstern (1977) suggest the most promising relationship among multiple parties-at-interest is one of mutual education, the chances of this happening smoothly, if at all, are remote.

There are individual differences in how participants understand and diagnose the problem, even when they agree a problem exists, especially if they have different functions, interests and disciplines. Each is more comfortable defining the problem within his own domain of expertise (MacDonald 1982a,b). For example, practitioners cite difficulties in implementing methodology when it must be justified to those from other disciplines on the study team, or to other parties-at-interest. Many SIA practitioners would agree with the statement that selecting methodology is a conflict-ridden process; that they "must have both the patience and persistence to design a study in which the link between the [parties'] . . . concerns and the methodology are apparent, but that at the same time conforms to their standards of research reliability. . . . [For example] the neutrality of a random sampling procedure, the cornerstone of the researcher's procedure for recruitment, is anathema to a highly politicized community group" (Durlak and Morgenstern 1977:30).

When the parties-at-interest have different value systems, they may also have different languages, and different ideas of timing and timeliness; the affective and social aspects of the situation become very pronounced (Kochen 1980). Consider the differences in meaning attached to TransAlta's decision to act as the developer for the new hamlet of Keephills. "The choice of a developer for the new hamlet became a contentious issue. . . . Residents believed the developer could anticipate high profits; the community desired to be the developer. Through a communication process of consultation and interaction it became apparent that the community was not really objecting to TransAlta being the developer but instead to the process of being left out of the decision" (Prokop 1983:6). Needless to say, this conflict took a great deal of time to resolve, because the parties had first to understand each other's viewpoint.

Conclusion: Based on the management literature, we assume that the more, and more varied, the representation in the monitoring exercise, the more difficult it will be to execute. The management literature suggests that the potential for quick consensus is reduced as the number of individuals increases. In other words, efficiency decreases; but, in our opinion, the potential for effectiveness increases.

The Issue of Commitment

Commitment is important because it gives an added measure of security in what can be a turbulent management context. The monitoring process may be stretched over a long period of time and address items that are not high priority to specific parties. Davidson (1984) suggests that support of all parties is required for successful impact management monitoring, in other words, that all parties are sponsors of monitoring in the sense of providing moral support. Other practitioners support this notion, stating that monitoring is so complex that it requires the awareness and commitment of every potential party-at-interest.

Conclusion: Support, or commitment, of all parties-at-interest, is essential for effective monitoring. This support does not necessarily mean active involvement.

Degree of commitment can be shown in three ways. First, by corporate policy or statements from senior management. Krawetz (1981c) compared the philosophical statements of two utilities engaged in SIA monitoring, demonstrating the difference implied in corporate commitment to monitoring; also, Giles (1985) states corporate philosophy is an important factor. As Krawetz (1981c:19) notes: "Consider the contrast in the organizational commitment in the following statements:

> ...Ontario Hydro is committed to trying to working [*sic*] with the host community *on satisfactory methods and on solutions to the problems these impacts create.*
>
> ... *One of* Ontario Hydro's policies is that communities should not suffer as a result of the construction or operation of a generating station *(Walker 1979:2-3, emphasis mine).*
>
> *The decision was made to [monitor]. . . the Susquehanna Steam Electric Station (SSES). In this way a full case history would be available* which might prove to be of value *both to PP & L and to other interested parties . . . (Community Affairs, Pennsylvania Power and Light Company 1976:introduction, emphasis mine)*

Second, commitment can be shown by assured allocation of resources to the activity. Leistritz *et al.* (1980) state that continuity of professional and technical support is important. On the negative side, questions about continuity of the Huntly Monitoring Project made work virtually impossible for an entire year, because the staff spent most of their time developing justifications for continued funding in the face of program cancellation (Krawetz and MacDonald 1982). Some cases specify the amount of funding allocated to monitoring; few make evaluative comments about funding. Krawetz and MacDonald (1982) state that budget must fit project scope. For example, the Huntly Monitoring Project was based on massive, comprehensive information needs; however, the budget allocation was so tight that the researchers could not do surveys, hire staff, or travel to Huntly on the bus — fare was one dollar — on a regular basis. Often the sponsoring agency is ignorant of the scope of the work, the costs of implementing the methodology, and so forth; and monitors are ignorant of the ways of the budget scheme. Consultants are regularly perceived as producing minimal work for maximal fees because the fundor has no idea of costs or how these compare to actual in-house costs.

Third, commitment can be shown by active involvement of, or access to, senior management. In the Huntly Monitoring Project, the Vice-Chancellor continued to chair the steering committee on the grounds that if he delegated it to someone else, the client agencies would then send lower echelon staff and nothing could be accomplished (Llewelyn, pers. com.). At Keephills, the social consultants were brought in because a senior manager was personally acquainted with one of them. This senior manager was frequently involved with the community, and so long-term commitments, such as relocating the Keephills hamlet, could be made "on the spot."

In spite of the importance of commitment, so little SIA monitoring is done that it is worthwhile addressing the reasons for this apparent lack of commitment. We have identified seven institutional barriers which serve as disincentives to monitoring:

- Monitoring is viewed as a cost; it is an expenditure, not a profit item, for the private sector.
- Monitoring may identify problems. Problem identification implies some responsibility to correct those problems. The responsibility may be beyond the jurisdiction or responsibility of the monitoring agency. There are two consequences: the agency may feel pressured to act, regardless of jurisdiction; and the identification of problems may not be greeted with open arms by the agencies responsible and may create expectation of action among other affected parties.

- Monitoring has no direct benefits for many members of the private sector. Each project is unique and they may not plan to build others of the same class. Thus the benefits of monitoring and of learning from it are externalized. One exception is utilities, which have a rather narrow range of projects and a mandate to build more of the same; hence long-term knowledge is of direct benefit. It is not surprising then, that monitoring is often sponsored by utilities or by government agencies with far-reaching, long-term mandates.

- Monitoring is viewed as "make work." The combination of cost, fuzziness regarding who is responsible for consequent action, and lack of direct benefit portray the view of monitoring as "make work."

- Many academics lack the applied interest to undertake monitoring. Their counterparts, the consultants, who specialize in more applied techniques, depend on the interests of funding sources for work. Those sources are not interested in monitoring. For example, one practitioner applied for seed money to develop a simple computer model for scenario generation of basic SIA data. For two years he searched unsuccessfully for funding. We have had the same experience in developing unsolicited proposals for monitoring. Not one of them has been funded because the agencies could not see their use. We know of one provincial environment agency which refuses to fund SIA monitoring research on the grounds that it is not useful.

- SIA monitoring is not required by law. For the private sector, regulators are a major public to be satisfied. If the regulators don't require monitoring, why bother?

- Monitoring has no public lobby, except where high risk is involved, such as hazardous waste or nuclear facilities. In such cases, monitoring may be done for credibility, or so as not to jeopardize the proponent's share value and associated investments.

If commitment is weak, SIA monitoring is likely to be cancelled when it threatens other parties-at-interest who have more political clout (see also Miller 1984), or when the expected project impacts — usually a "boom" — do not materialize. To counteract this, project directors may travel and disseminate their research widely to make the international community aware of the project. The trip reports and requests for research reports are then used to demonstrate to the clients that the monitoring project is prestigious; this tactic was used by the Huntly Monitoring Project. To counteract vulnerability due to lack of demonstrated impact, Kopas (1980) suggests that the monitoring program use more sensitive measures. However, Davidson (1984) suggests that the lack of impact may assist with project success, inferring that it is less threatening to the other parties. Then again, some practitioners asked why it was necessary to continue monitoring in the face of undemonstrated impact.

CHAPTER 4: OBJECTIVES OF MONITORING

As stated in the definition of monitoring in Chapter 1, monitoring is not an end in itself, rather it is a means of achieving an objective. This idea is the subject of little direct discussion in the literature (Carley and Bustelo 1984; Conover 1985; Harvey 1982; Krawetz 1981c). In practice, objectives are just as often implicit, as explicit.

At least five categories of objectives for SIA monitoring can be identified:

- compliance with expected performance (e.g., inspection, surveillance in terms of regulatory permits, contractual agreements);
- impact management, i.e., project control to ensure that problems do not develop which interfere with construction through delays or cost overruns, performance evaluation;
- research and development, including straight documentation, enhancing technical capacity for future project planning, evaluating predictions, and testing specific hypotheses;
- credibility, that is, public assurance; and
- evidence of change, including determination of status, trend monitoring, and early warning systems.

The fact that monitoring is related to its objectives is supported by Kopas' (1980:9) statement, "in Revelstoke, the monitor is strictly an observer without any policing or coercive role. *Whether or not this is the desired role depends on the objectives of the particular monitoring program.*" (Emphasis ours.)

The management literature suggests that the clearer the monitoring objective is, the easier it will be to implement (Reddin 1971). This is supported in the SIA monitoring literature by Carley and Bustelo (1984), Davidson (1984), Giles (1985) and Krawetz (1981c); and in the biophysical literature by Christmas and Etzold (1977a,b) and Etzold and Christmas (1982), who successfully use management by objectives for impact management.

The terms of reference for our study require us to address the question of whether impact management monitoring and impact prediction monitoring are related.

Impact management monitoring is used in two ways: to show when intervention may be needed, and to show the results of intervention.

In the first case, for example, monitoring both the availability of rental accommodation and workforce influx related to a particular project may show an impending shortage of such housing. The various parties-at-interest must then decide what actions, if any, they can take to alleviate the shortage before it reaches crisis proportions.

Monitoring can be used to show the degree of success of the actions taken and whether additional action is warranted. In the previous example, once action has been taken to alleviate the housing shortage, further monitoring can be used to show whether, in fact, the shortage has been alleviated.

At its best, impact management monitoring uses rolling targets, that is, short-term forecasts which are continually updated or revised on the basis of new information. Revised forecasts are essential, not only because the situation being monitored changes, but also because intervention or action, such as taking measures to alleviate a housing shortage, is expected to change the situation. We believe impact management monitoring is essentially a form of action research, based on direct, continuing intervention into the object-of-study.

Prediction monitoring has three meanings: verifying predictions, improving the predictive capability of SIA, and making short-term forecasts.

Freudenberg's (1976) work is the best example of verifying predictions made in an SIA Statement, for he takes predictions made in the SIA Statement, formulates them into hypotheses, and then tests them on-site. In other words, he grounds the predictions. Using the housing shortage example: If an SIA Statement predicts a housing shortage when the construction workforce peaks, prediction verification monitoring would be used to show whether the prediction came true. In either event, what actually happened can be described and related to the original prediction.

Freudenberg demonstrated that prediction verification monitoring will generally show that SIA Statements lack predictive capability. Murdock *et al.* (1982) agree. They identify several factors that limit the validity and reliability of predictions: the complexity of projections, numerous potential sources of error, and limited data. Like many practitioners interviewed, they suggest that the predictions in an SIA Statement be used mainly for sensitivity analyses and for evaluating the resultant policy implications. Unlike impact management monitoring, no immediate intervention to improve or manage the situation is implied. Recently, the concept of auditing has been used in comparing EIA predictions to actual effects. We believe auditing is similar to this meaning of prediction monitoring.

Monitoring for improving the predictive capability of SIA consists in finding out what really happens during the construction and operation of a facility, through documentation, observation, or hypothesis testing. Unlike prediction monitor-

Table 5
Similarities and Differences Between Effective Impact Management Monitoring and Prediction Monitoring (based on literature and cases)

OBJECTIVE	IMPACT MANAGEMENT MONITORING Management of impact Interventionist	PREDICTION MONITORING Prediction/Verification Non-Interventionist
MONITORING APPROACH		
SCOPE	Varies. Focus may be through conceptual model and/or management considerations, i.e., variables limited to those over which there is jurisdiction, the ability to intervene and to manage.	Varies. Focus through conceptual model essential or scope becomes unwieldy.
	Biophysical integration unlikely.	
COLLECTION AND ANALYSIS	All aspects of data management may be at issue.	
	If data contributors/owners receive no direct benefits from participation, motivation and access become an issue.	
INTERPRETATION	Assessment of significance and of causality remains difficult.	
	Because of need for decision and action, interpretation must be negotiated.	No requirement for negotiation of interpretation.
FEEDBACK	Short-term utility is essential. Use of results must be high and ongoing.	Variable. No short-term or direct use.
	Requires feedback loop to operational side of project and all parties involved.	No necessary link to project operations or to all affected parties.
THE MANAGEMENT PROCESS		
PROCESS OF ANALYSIS	Must be orderly, systematic and iterative.	
ORGANIZATIONAL ARRANGEMENT	Varies.	
PROCESS MANAGEMENT	Inclusion of all potentially affected parties essential as decisions, etc., are interrelated.	Inclusion essential but usually viewed as less so. Hard to generate long-term interest. Of most interest to academics and those who see need to study problems going beyond agency mandates.
	Role of community varies, often limited to legal entities. Credibility considered important.	Role of community varies but likely lower interest than with Impact Management and less direct concern about community credibility.
	Many barriers against commitment.	
	Commitment of all parties required.	Commitment of funding agent required.
	User commitment essential, as necessary for use of results.	User commitment not at issue.
	Sponsor commitment essential and likely because of direct link between sponsor need and monitoring exercise.	Indirect link between sponsor need and monitoring exercise.

ing for verification, monitoring for improving the predictive capability of SIA does not require any relationship to the SIA Statement. The lack of intervention in the situation being studied is similar to prediction verification monitoring.

Both of these forms of prediction monitoring are essentially longitudinal studies.

Monitoring can involve the use of short-term forecasts, which may be updated, i.e., impact management monitoring. This third meaning of prediction monitoring results in considerable confusion in the SIA community. Using this meaning, prediction monitoring and impact management monitoring are identical.

In this report, we distinguish between impact management monitoring and prediction monitoring, and we refer to prediction monitoring in terms of the first two meanings described above. We believe that using the term prediction monitoring to refer to short-term forecasting or rolling targets confuses the meanings attached to prediction monitoring in SIA.

Does the objective make a difference in the monitoring approach or the management of the monitoring process? The literature we reviewed has not addressed the implications of the different objectives in this way, with the exception of one report (Krawetz 1981c). We infer that for most authors this is not an issue and/or that they believe that there is no difference. In our opinion, the monitoring objective does make a difference in both the monitoring approach and the management of the monitoring process, as shown in Table 5. Impact management monitoring and prediction monitoring differ in four ways: the degree of intervention, data interpretation, time frame, and commitment.

First, in impact management monitoring, intervention is expected on an as-required basis. Using the housing shortage example, the object of impact management monitoring is to take action to alleviate an impending housing shortage. In prediction monitoring, it is important not to intervene in the situation. Rather, one watches the housing shortage unfold, either to describe it or to verify its occurrence with a prediction.

Second, impact management monitoring and prediction monitoring differ in the nature of the data interpretation process. In impact management monitoring, action may be required. For example, data may show a trend toward a housing shortage. The significance of that trend, however, may be the subject of debate, because, more often than not, a clear cut interpretation is not possible. Faced with this situation, several practitioners mentioned that the parties-at-interest would negotiate the significance of the data. For example, if everyone discusses the trend toward a housing shortage and can come to an agreement that it is potentially severe, based on their knowledge of the situation, then the interpretation, "potentially severe housing shortage" is given to the data. Because the situation is allowed to unfold in prediction monitoring, there is no need to use negotiation as a means of data interpretation.

Third, impact management monitoring and prediction monitoring differ in terms of the time frame in which results are needed. The action orientation of impact management suggests that affected parties will have immediate, direct needs for monitoring data, that is, they will need to know about a potential housing shortage, in order to act before it becomes a crisis; hence the need for feedback between the monitors and other, affected parties. Prediction monitoring has no such requirements: results are not needed immediately nor are they expected to be directly useful to affected parties. As a result, we assume it is difficult to get and maintain the interest of these parties.

Fourth, the nature of commitment differs. In impact management monitoring, we assume that commitment is needed by all affected parties because the actions of one affect the jurisdiction of another. Thus, orchestrated action across parties would be required for successful impact management. We assume that the commitment of both the users of the monitoring information and the sponsors of such a program is based on the level of need they have for the program and its results. In prediction monitoring, the commitment of all affected parties may be desirable, but difficult to achieve for lack of interest. Commitment of the funding agent may be all that can be expected. We assume that the short-term needs of the data users and/or the funding agent are not at issue, given the relatively less immediate orientation of prediction monitoring.

Conclusion: We believe that impact management monitoring and prediction monitoring are incompatible. The former assumes intervention will happen and is prepared for it, while the latter requires that the monitoring team not intervene in the situation being monitored. Therefore, we believe that monitoring the same project for both monitoring objectives is like trying to move in opposing directions at the same time. Effective monitoring requires concentration on one or the other of these objectives. This is further supported by the fact that the data systems and management processes required of impact management and of prediction monitoring differ greatly. The former requires a highly responsive, user-oriented data system and management process because of the need for immediate, directly useful information on which to base action. The latter has no such requirements for immediacy or direct utility.

CHAPTER 5. A FRAMEWORK FOR EFFECTIVE MONITORING

INTRODUCTION

In this chapter we revisit the framework for effective monitoring, outlined in Chapter 1. Here we specifically consider our case studies.

We believe the framework for effective monitoring consists of three factors:

- a monitoring plan involving scoping, collection and analysis, interpretation and feedback, as described in Chapter 2;
- process management, involving a process of analysis, organizational arrangement, and the participation of the parties-at-interest, as described in Chapter 3;
- dependence on the objective for which it is undertaken, specifically in this report, on impact management or prediction, as described in Chapter 4.

Figure 1 illustrates this framework.

DEVELOPING THE MONITORING PLAN

Premise 1: Scope should vary with the type of project, the type of community and the issues related to the interaction between the two.

We believe that at least two of the cases support this premise, Keephills and AOSERP. The Atikokan case does not, and we believe that this fact is related to some of the difficulties Ontario Hydro encountered.

The scope of the monitoring plan at Keephills is decided through the interaction of the company and the community; if individuals become concerned about a specific aspect of the project, that aspect is included in monitoring. While this does not follow orthodox SIA procedure, that is, the scope does not consist of a list of impact categories based on similar projects or community types, it is consistent with our first premise.

The scope of the Atikokan monitoring program is based on Ontario Hydro's 14-factor list of what comprises SIA areas of analysis. The list is a fixed guide for all projects in which Hydro is involved, though not all monitoring projects sponsored by Hydro collect the entire range of data. There is no indication that community type or project type are important considerations, other than the fact that all Hydro projects relate to utilities. We believe there is potential to "drown in the data." Hydro personnel said they collected a lot of data, but the extent of the its usefulness was limited. The Hydro approach does not follow our first premise and, by implication, we question the relevance of some of the data gathered and some of that excluded by the list.

To our surprise, Hydro personnel stressed that the data were necessary; seemingly irrelevant data gathered in one year would play a significant role in negotiating compensation a few years later. Hydro personnel felt they would have been vulnerable without the background data, because they would have been unable to defend the extent of compensation requested, to Hydro management.

When AOSERP began, there was little information about project type, since the technology for oils sands plants was being scaled up for the first time ever in the AOSERP study area. There was little information on the community of Fort McMurray and the surrounding areas. The SIA "boom" literature was, at the time, insufficient to guide the program. In short, the AOSERP case violates our first premise, but not by design, rather by circumstance. We believe this is one reason why the program was ineffective.

Premise 2: The scope should be based on a model developed in consultation with the parties-at-interest, to guide data collection.

We believe all three cases support the validity of this premise.

The scope in the Keephills case is based on a process model that made dialogue between the company and the community essential. By all accounts the model is working well. Again, this is not orthodox SIA procedure but it is consistent with our second premise.

We hesitate to call the factor list in the Atikokan case a model, particularly in terms of causal linkages, because these linkages, in our opinion, are unclear. However, both the Township and Hydro established the Agreement, and attached the list of factors. Both, it seems, wanted to cover any eventuality and thus were comfortable with as comprehensive a list as possible. The Hydro approach does not follow our second premise entirely and while there were benefits to the approach taken, it did result in problems with determining causality.

Several unsuccessful attempts were made in AOSERP to develop a model. Program management realized a model was needed for guidance but were unable to develop one. We believe the difficulty lay in the combination of a complex, ambitious terms of reference and the diverse nature of the agencies involved; no single model could be satisfactory. There was consultation with some of the parties-at-interest, through the Human System Advisory Committee expressing its interests and reviewing terms of reference and through the reports submitted by consultants. However, not all the parties

involved agree that the approach was consultative, and there were problems with excluded parties. In our opinion, AOSERP violated our second premise because of inappropriate process management, which proved to be a major problem for the program.

Premise 3: For best fit, the model for impact management monitoring should be based on the "Target Tracking" or "Rolling Target" approaches; whereas for prediction monitoring the "Information Sponge" or "Target Tracking" approaches are suitable.

The cases support the validity of this premise.

The model used at Keephills is a form of "Rolling Target." Targets are the company's and community's perceptions of comfort, which are melded through discussion. The targets are reset on an as required basis, determined by the issues brought forward for discussion and the perceived satisfaction of their resolution. Again this is not orthodox SIA procedure but it is consistent with, and supports, our premise.

Our first impression of the Hydro approach at Atikokan suggested that the "Rolling Target" model was used. However, interviews verified that no targets were set (except for housing, whose impacts did not materialize). In fact, the Hydro approach was "Information Sponge." This violates our premise and we would expect considerable difficulty in actually managing impact based on the lack of targets. However, personnel we interviewed said this was not the problem we expected, because the "boom-bust" cycle did not eventuate and the impacts were minimal. We believe the validity of these comments need further testing in an actual "boom" situation, and suggest that under such circumstances, "Information Sponge" would not work well because it gives no direction for impact management action.

In the case study, we identified the AOSERP approach as "Information Sponge." This is consistent with its orientation toward prediction. However, the same approach was of no use to the program in providing guidance for impact management, another of its objectives. In "Information Sponge," anything can be relevant; impact management requires more focused guidance.

Premise 4: Biophysical linkages, although usually not established in practice, are desirable. If they are to be established, they should be done at the beginning of monitoring.

It is difficult to evaluate this premise because biophysical linkages were not attempted in two of the cases. However, the Keephills case shows that they can be part of SIA monitoring. We believe there are many barriers against linkages and these are discussed in Chapter 6.

Biophysical linkages have been established in the Keephills case, mainly because community members raise issues of concern to them, regardless of the disciplinary boundaries. We noticed, however, that while there are many important issues, community members feel they have energy to deal with only a limited number at a time, and focus on those of greatest priority first. As the major issue, the relocation of the hamlet of Keephills has been resolved, community members have had more time for biophysical issues. Again this is not orthodox SIA procedure but is consistent with, and supports, our fourth premise.

The Atikokan approach has no biophysical linkages. Recently air pollution has become an issue because of the station's proximity to Quetico Park. However, the matter is being handled separately from the SIA monitoring component and does not appear to be of concern to the Township. The extent to which biophysical linkages could have been relevant is unknown.

AOSERP was never set up to integrate social and biophysical elements, although interdisciplinarity was an objective. All such attempts at integration failed, in part, we believe, because they were attempted well after the program started. (The reasons for this are discussed in the next chapter.) Therefore, the program violates our fourth premise.

Premise 5: If the monitoring project relies heavily on data generated by other sources, then timeliness will be problematic. This is more important for impact management monitoring than for prediction monitoring, because of the former's need to provide short-term information on which to base action.

Many monitoring programs depend on government-generated data for a large portion of their data banks. It is assumed that since many government agencies gather data routinely, it will be a simple matter to rely on these sources. In our experience, it is not. Two of the cases support this premise; we believe it is circumstance which prevented timeliness from becoming an issue at Atikokan.

Data from other sources did not play a major role in the Keephills case. However, several of the community members interviewed did express disappointment with the time lag between a request for, and receipt of, information from government agencies.

In the Atikokan case, timeliness was not a major issue even though impact management monitoring was undertaken, because the impacts themselves were minimal. However, the co-ordinator remarked that the government-generated data was very good, but very late. We suggest that had Atikokan gone through "boom and bust," data timeliness would have been a key issue.

The AOSERP case is not as easy to evaluate because the compendium was not implemented. Given our knowledge of the case, we believe that timeliness would have become an issue because of the lack of commitment from government agencies to provide the necessary data.

Premise 6: If the monitoring project relies heavily on data generated by other agencies, then access will be problematic.

This premise applies to two of our cases: Atikokan and AOSERP. The cases offer insufficient evidence for this premise, although access was not a problem in Atikokan. We believe this was the case because local data sources were

being accessed by a trusted local resident. Finding data that matched the monitoring project's need was difficult at times, because each agency used different boundaries. The AOSERP case is not as easy to evaluate because the compendium was not implemented. We believe that data access would have become an issue because of the lack of commitment from government agencies.

We believe the assumption that, for example, a government-funded project will obtain easy access to another government agency's data, is naive. Such access only comes with commitment.

Premise 7: If the data owners get no benefits from data sharing, then motivating them to continue providing data will be an issue. This is particularly the case with prediction monitoring, where the contributor may not see a direct link between the contribution and the benefit from this contribution.

This premise relates to one case, Atikokan, where it was supported. Motivation was an issue at Atikokan, but the co-ordinator solved it by inviting representatives from the various agencies to luncheons with visiting Hydro staff from head office.

Premise 8: If access to data generated by other sources becomes problematic, strategies to improve access or data-generating alternatives must be developed.

More often than not, monitoring programs do not have additional resources to generate a lot of primary data. Thus, alternative strategies should be considered. This premise is supported by the cases, with the exception of Keephills where it did not apply. In the Atikokan case, the co-ordinator used the luncheon strategy mentioned in Premise 7 as a way of rewarding agencies and encouraging their continued co-operation. The alternative to depending on existing data, generating primary data, was used in various AOSERP studies. With the compendium, however, the costs of generating primary data would have been prohibitive.

Premise 9: Expertise will be at issue, particularly the trade-off between the use of local residents and experts. Credible, local residents should be included to the extent possible.

We believe the cases support this premise.

Two of the cases, Keephills and Atikokan, used local residents; the company and the community in both cases feel this is of mutual benefit. Local residents in the Keephills area are the prime data source for the model used. At Atikokan, a credible, local resident serves as co-ordinator and Ontario Hydro personnel have remarked that this has been very important to the success of the project. In one situation, the co-ordinator hired local residents but had data analysis conducted elsewhere, combining the best of both worlds.

The AOSERP case did not involve local residents and has been criticized for this. In fact, some practitioners suggested this is one of the reasons the AOSERP studies were not directly relevant to the communities being studied.

Premise 10: The measurement of change and the assessment of its significance are the major methodological problems in monitoring. Most projects will not be able to distinguish project-related changes from those generated by other factors.

All cases had problems with measuring change, attributing cause and weighing significance. This is less so at Keephills, where as long as causal links are perceived as such and brought up for discussion, negotiation and study occur. At present, there is some difficulty over the relationship between strip mining and the condition of local water wells.

In the Atikokan case, there was considerable difficulty attributing cause, particularly when the expected impacts did not happen and other variables intervened. This occurred with the housing predictions and with attempts to study drug abuse. These difficulties support our premise and are, in part, related to difficulties with the model used.

AOSERP, too, had difficulty dealing with the measurement of change. This accounts, in part, for the number of recommendations from research projects that were not implemented.

Premise 11: Negotiation of significance is essential in impact management monitoring, because of Premise 10.

The two impact management monitoring cases support this premise. The Keephills approach emphasized discussion and negotiation. At Atikokan, negotiation, through discussion, played a major role in determining significance. The assessment of significance was not always supported by monitoring data, although on other occasions it bolstered jointly presented arguments to project managers for compensation.

The significance of project results for AOSERP was determined by their perceived relevance to the participating agencies. However, the significance of impact was not addressed specifically and AOSERP was not responsible for the management of impacts, only for identifying them.

Premise 12: Prior to taking action in impact management, the following should be addressed: whether action should be taken; whether taking that action is within one's mandate; and what action is possible, that is, action that will make a difference.

Both impact management monitoring cases did address these issues. However, the problems they experienced in doing so were different. In the Keephills case, the problematic area is mandate. According to some of those interviewed, TransAlta found itself assuming responsibilities it did not feel it should have, had other agencies fulfilled their obligations. It did so to maintain positive community relations. In the Atikokan case, Ontario Hydro did not find it difficult to deal with mandate, as TransAlta had in the Keephills case, because it specified in its Agreement that it would not provide compensation to remedy impacts that were in the jurisdiction of government agencies. Hydro and the Township did, however, bring these impacts to the attention of the government agencies. We suspect the pressure for action on Hydro's part might have increased, had Atikokan been experiencing a "boom." Hydro had difficulty in terms of what action was possible. For example, it was difficult

to determine what action, if any, would solve the rental housing shortage, because many intervening variables existed. This premise does not apply to the AOSERP case.

Premise 13: User-friendly reporting procedures must meet user needs, as the users perceive their needs.

All cases support this premise. In all cases, discussion and personal contact played an important role. In the Keephills case, the major reporting procedure was face-to-face discussion, individually and in small groups. This appears to have been highly satisfactory to all parties, as well as very effective in distributing information, resolving misunderstandings, and providing a vehicle for discussion. In the Atikokan case, most contact between Ontario Hydro, the co-ordinator and Township Council was by phone and face-to-face discussion. As in the Keephills case, this appears to have been highly satisfactory and very effective. An annual report was produced as well, but we have no evidence from the users about its usefulness.

In the AOSERP case, results were discussed at meetings of the Human System Advisory Committee. Reports of the level of satisfaction and perceived effectiveness vary, depending upon the individual. Information distribution for AOSERP was mainly through scientific reports and seminars held to provide program updates to the scientific, government, and consulting communities. In our opinion, AOSERP's distribution of research documents seems appropriate to its prediction monitoring objective and the nature of the community these documents would serve: consultants, academics, and government agencies. However, some users expected the reports to be directly useful to impact management, and thus have been dissatisfied.

Premise 14: The meaning of "use" varies with monitoring type. In impact management monitoring, use is direct and immediate. In prediction monitoring, it is more likely to be indirect and long-term.

In theory, direct and immediate use of data follows logically from the need for action in impact management monitoring. However, it does not seem to apply to our impact management monitoring cases. As a result, we believe that the need for direct and immediate use may apply more readily to "boom" or turbulent situations.

The premise did apply to some situations in the Keephills case, particularly during the first year when there was a need to resolve the issue of relocation and thus maintain project viability. In these situations use was direct and immediate, facilitated by the presence of senior managers able to make decisions "on the spot." But there were some complex issues where one, or more, of the parties needed more time to think through the implications. For example, data were traded back and forth for several years before decisions were made on a land acquisition policy. In such circumstances, immediacy was not seen as important by the stalling party, though others may have had a different view.

In the Atikokan case, use of the monitoring data was not always direct and immediate. In some cases, monitoring data was not used to provide the support for compensation requests. Immediacy was not an issue. Both Ontario Hydro personnel and the co-ordinator stressed the need to take their time in negotiating the meaning of the data. We believe this is the case because Atikokan did not "boom" and thus immediate action was not required.

The extent of data use in the AOSERP case has not been documented. Participants' perceptions of the data's usefulness vary. Those who expected immediately relevant material for impact management were dissatisfied. However, we suspect that there are several reports that have influenced other research or the actions of other agencies in a less direct and less immediate manner.

Premise 15: The monitoring plan should be both simple and complex. An effective monitoring plan uses the fewest possible key variables while retaining a sense of the whole and its complexity.

We believe the cases support the validity of this premise, although they also show that achieving simplicity and complexity is easier said than done. The Keephills case fits our premise best because it is based on a very simple plan, continual discussion, which has handled a very complex, often turbulent situation. The model used in the Atikokan case was relatively simple, but, in our opinion, not sophisticated enough to grasp the complexity of, say, the housing situation. However, other aspects of the plan, such as its feedback mechanisms, showed an effective balance between simplicity and complexity, by keeping the number of parties small, yet having several feedback connections between and among them. The AOSERP case suffered from too much complexity and turbulence which, for a number of reasons, could not be simply conceptualized. While case-related practitioners agree on the need to focus on major issues, it seems that data, no matter how weak or peripheral, are an important tool to justify actions to senior management.

Premise 16: An effective monitoring plan is practical; it can be implemented within the constraints of the situation.

The cases support the validity of this premise. Our assessment of the Keephills case is that the plan is very practical, but others will argue that its practicality is limited by its labour-intensive nature and high cost. The overall plan for the Atikokan case was practical, though we argue that the comprehensive factor list was not. There are arguments in favour of having data — just in case. In the AOSERP case, it was difficult to implement the program. In our opinion, AOSERP attempted to do too much with too little; the plan was not practical. The variety of problems encountered with implementation are described in the case study.

DEVELOPING THE MANAGEMENT PROCESS

Three concurrent tasks in process management are ensuring that the process of analysis is orderly and systematic; developing the proper organizational arrangements to promote co-operation among interdependent units or agencies; and ensuring the appropriate involvement and participation of the

parties-at-interest, by managing the relationships. Each of these tasks is discussed here in a series of premises.

Premise 17: Ensuring that the process of analysis is orderly and systematic: the process of analysis is essentially social, requiring the use of different problem-solving styles in sequence. It is not logical and linear.

We have insufficient information to evaluate the cases in terms of this premise. Personnel from all cases would agree, however, that the process of analysis defies the rules of logic.

Premise 18: Organizational arrangement: responsibility must match authority.

Our cases support this premise. One of the best illustrations of the need for such a match is in the Keephills case. The Keephills Power Project Steering Committee has been unable to take action on monitoring, although it is specified in its terms of reference. According to some participants the Steering Committee has no authority to act. As a result, TransAlta has felt the need to act in areas beyond its own mandate, in order to maintain positive community relations. The arrangement at Atikokan ensured that responsibility matched authority, as specified in the Agreement. For example, Hydro would not assume responsibility for matters under provincial government jurisdiction. Of our three cases, AOSERP best demonstrates what happens when responsibility and authority are not matched. While the program had the responsibility to fund research and proposed to fund impact management monitoring research, it had little authority to actually manage impacts or to feed into another impact management system. Had the program continued, it would have been undertaking impact management monitoring in an impact management void, generating data that would not be systematically acted upon.

Premise 19: The organizational arrangement must recognize interdependencies, within and outside the host organization.

Our cases support this premise. In all cases, several parties-at-interest were recognized and attempts were made to include them, because of the mutual need for information. Also, impacts normally transcend jurisdiction and thus require the co-operation of all parties to respond. At Keephills several feedback loops between various parties ensure that everyone is updated. Problems within TransAlta existed because several groups in the company had jurisdiction for different aspects of the power project. For example, the land acquisition practices were at odds with the community relations approach. This resulted in great concern and discussion at company-community meetings about double messages being received from the company. In the Atikokan case, many parties-at-interest served as contributors, although they had no formal involvement with the Agreement. In the AOSERP case, some interdependencies, largely within government, were recognized, through the formation of the Advisory Committee. However, according to some individuals, key parties, such as representatives of the Indian bands, were excluded, to the detriment of the program.

Premise 20: The responsibilities assigned to the monitoring organization should match its informational, technical, and financial resources.

All cases support this premise. In the Keephills case, community members said they would prefer, at times, to have had monies to purchase their own technical advice. Lack of parity between the company and the community is an issue. In some cases, TransAlta has paid for such services; in others, the company and community have jointly chosen a particular consultant. A practitioner said that informational resources would improve at Keephills, if the government agencies involved had regional offices, because regionally based personnel are familiar with an area and its problems.

In the Atikokan case, Ontario Hydro did pay for the Township's co-ordinator and for whatever studies were identified. It also provided in-house resources. The Township has been satisfied with this approach and the budget specified in the Agreement was sufficient. However, some practitioners argue that the Township hardly has the independent resources to disagree with Ontario Hydro.

In AOSERP there is a lot of disagreement about whether the necessary technical resources were available. We believe the budget was too small to accomplish the ambitious terms of reference.

Premise 21: Continuity of professional and technical support is essential and/or a strategy is needed to deal with discontinuity and turnover.

Our cases support this premise. In the Keephills case, support has been continuous. Many of the same people have been involved over the entire nine years of the project. At Atikokan, four different community studies planners were involved over nine years; however, they came from the same organizational unit and were able to brief each other. Moreover, there has been only one local co-ordinator providing the needed continuity. In AOSERP, discontinuity was a fact of life and few strategies were in place to handle it. Given extensive turbulence, a variety of strategies were needed.

Premise 22: The organizational arrangement must fulfill ritualistic obligations.

One case, Keephills, supports this premise. At Keephills, the consultants said it was very important for the heads of community associations to meet with senior managers in TransAlta, acknowledging their similar positions. The Steering Committee is seen by some as fulfilling ritualistic obligations because the committee itself takes no action, but is a formal forum for displaying decisions made between the company and the community. We have insufficient information from the other cases to reach a conclusion.

Premise 23: In general, the organizational arrangement must fit the domain or management situation in which it exists, whether internal or external to the organization. If the nature of the external situation is at odds with an organization's structure and the structure is entrenched, the monitoring project's effectiveness will be hampered.

At least two cases, Keephills and AOSERP, support this premise. The organic structure used in the Keephills case was effective for a turbulent situation, as Goldenberg (1984) has shown. We have no indication that the structure used at Atikokan did not fit. In the AOSERP case, a relatively mechanistic structure of committees and hierarchy did not suit the turbulence of the situation. However, the structure had to satisfy other public sector objectives and was entrenched. As a result, we believe AOSERP was not able to be highly responsive or effectively deal with the turbulence in the situation.

Premise 24: The relevant parties-at-interest must be invited to participate. They should be chosen on the basis of expertise; mandate, including representativeness and accountability; thinking styles; and task and people preference.

We have insufficient evidence from our cases to fully evaluate this premise, particularly concerning the criteria of thinking styles and task and people preference. None of our cases chose parties on criteria other than expertise or mandate.

As mentioned in Chapter 3, the validity of this premise is best shown when excluded parties make their wishes known. Every case has some excluded parties, but the significance of exclusion varies. At Keephills, the consultants now wish they had involved a neighbouring community more, since the relocated hamlet was very near its boundary. At Atikokan, some groups have interests related to monitoring, in particular, groups concerned about air pollution. However, no mechanism is in place to invite them to participate. AOSERP did make an effort to include relevant parties as it defined them. As we have stated before, several key parties were excluded; this may account for some of the reasons research questions were not directly useful to the local communities.

At Keephills, accountability is the major issue related to this premise, because there is no way to ensure that the COKE representatives are accountable to the community. After nine years, this is becoming a problem, according to people interviewed, because of a recent change in representatives. Various people are concerned that this will hamper effectiveness. The case study describes how surveys check whether the issues brought forward are representative.

At Atikokan, accountability is ensured through the Agreement; Township Council is elected and is thus accountable to the community. Whether Council is representative is open to question, for many SIA studies show that local government is seldom fully knowledgeable and representative of all its citizens' views. Ontario Hydro personnel said that accountability is very important in ensuring effectiveness.

Premise 25: The process must create an atmosphere of trust, allowing all participants to express their views without fear of reprisal or derision.

Evidence from our cases is inconclusive but suggests support for this premise. At Keephills various discussion opportunities allowed all parties to express their views. The Atikokan case is similar. We believe such an atmosphere was missing in the AOSERP process; at times people did not express their concerns for fear of reprisal, thus matters that ought to have been discussed were not. We believe this contributed to the ineffectiveness of the program.

Premise 26: All parties must be committed to the monitoring project, for example, through policy, the active involvement of senior management and/or assured allocation of resources. This does not necessarily mean active involvement. If commitment is weak, alternative strategies should be implemented to ensure support.

All cases support the validity of this premise. As we have shown in the case studies, the major parties at Keephills, COKE and TransAlta, are committed to the monitoring process. The Steering Committee appears to be less active, but this reflects the lack of authority given to the Committee. In the Atikokan case, all parties had a high level of commitment stemming, in the case of Ontario Hydro, from senior management policy; and in the Township, from the desire to get a fair deal for Atikokan. This commitment was reflected in the signing of a legal agreement. AOSERP also had a legal agreement between its fundors, but the agreement was broken. Discontinuity of financial and individual commitment was a major reason for the program's ineffectiveness.

Premise 27: Essential qualifications of the monitor are research credibility, local respect and process management skills.

Our cases show that these characteristics do not have to be met by one person. In Keephills, these criteria were met by different people. This did not present difficulties, since monitoring is a group effort. The consultants have research credibility, members of TransAlta and the community have local respect, and the key TransAlta representative has process management skills. In Atikokan, Ontario Hydro planners and the local co-ordinator have research credibility, and the co-ordinator has local respect. We have no evidence about the level of process management skills. In AOSERP, according to various participants, these criteria were not met: for some, research credibility was lacking; for others, local respect; many felt process management skills were weak.

Premise 28: The most effective monitoring involves the entire range of parties. The more, and more varied, the representation, the more difficult it will be to execute the monitoring plan.

Case-related practitioners agreed with this premise but suggested that a core group is needed, with others brought in as required.

OBJECTIVES

Premise 29: A monitoring program should not contain both an impact management and a prediction objective, because these objectives are incompatible.

One of our cases, AOSERP, relates to this premise. In Appendix A we show how difficult it was for the human system committee to achieve its objectives. Trying to achieve incompatible objectives was one of several reasons for ineffectiveness in this case. We know of two other monitoring

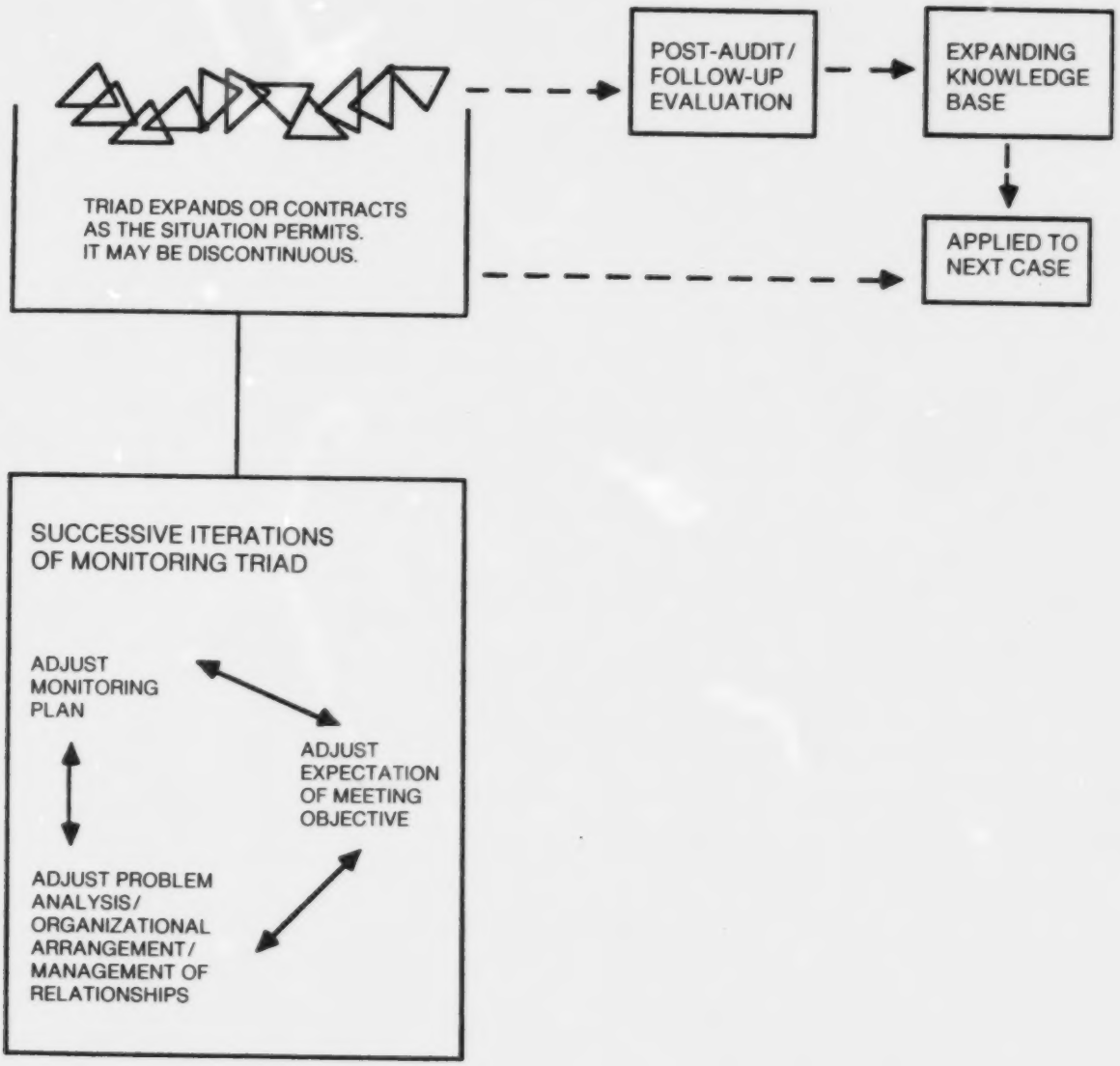


Figure 4. Iterations of the Monitoring Triad Over Time

projects, the Huntly Monitoring Project in New Zealand and that at Revelstoke, British Columbia, which also tried to meet both objectives. In both cases, the two objectives could not be met and in the end the projects resembled longitudinal studies, i.e., a form of prediction monitoring. We believe, therefore, that the premise has merit.

Conclusion: Based on the literature review and case studies, we conclude that effective monitoring takes the three aspects of monitoring plan, management process and the monitoring objective into account. These form a framework, or monitoring triad.

THE RELATIONSHIP AMONG ASPECTS OF THE MONITORING TRIAD

The key to the relationship between and among the three aspects of the triad — monitoring plan, management process

and monitoring objective — is the degree to which each fits the others. Depending upon the congruence of the fit, the three aspects can reinforce one another, or work against each other to inhibit effectiveness.

Examples of good fit include TransAlta's organic structure, which suited the turbulent situation at Keephills, and the presence and involvement of senior management, consistent with the company's objective of community credibility. There is poor fit between the community-based model and the lack of checks and balances for accountability and representativeness in the community members of the Steering Committee. This lack of fit is becoming noticeable now, because of a change in Steering Committee membership.

Good fit in Atikokan is shown by corporate commitment to compensate for impact and the reflection of this intent in the Agreement; and by the use of a respected, local co-ordinator and Ontario Hydro's desire for community credibility. There is poor fit between the main monitoring objective, monitoring to verify impacts as the basis for compensation; and the compensation practices, which at times ignored the data. This reflected problems with the model used; when data were not useful, negotiation of significance supplemented and/or replaced them.

In AOSERP there are many examples of poor fit: between the objectives of impact management monitoring and the lack of an impact management system; between the mechanistic organizational design and the turbulence of the situation; and between the need for long-term research and the lack of commitment of the funding agents. These factors worked against each other and the program could not succeed.

Case-related practitioners confirmed that none of the situations were static. They all had elements of the unexpected; hence, the need for flexibility.

Conclusion: Effective monitoring is a continual process of readjustment of the three aspects of the triad to maintain maximal fit. as shown schematically in Figure 4.

CHAPTER 6: OUTSTANDING ISSUES

INTRODUCTION

In this chapter we address four issues:

- the applicability of the framework to pre- and post-decision monitoring;
- the applicability of the framework beyond the three case studies;
- the applicability of the framework to both the sociopolitical and technical paradigms of SIA; and
- the issues of linkages between EIA and SIA monitoring.

THE APPLICABILITY OF THE FRAMEWORK TO PRE- AND POST-DECISION MONITORING

The terms of reference require the development of frameworks of pre- and post-decision monitoring, that is, monitoring in the context of the regulatory process, as shown in Figure 5.

SIA monitoring is essentially a continuation of the concept of the four steps outlined in Chapter 2: scoping, data collection and analysis, interpretation, and feedback of results. Logically there is no reason why monitoring cannot begin before project approval. The best case example is Keephills, which essentially had no break in continuity between the site search and a monitoring process that is still functional after nine years. Significant factors in proponent willingness to sponsor such activity were a highly likely project approval, given the previous refusal and the energy crisis, and a short interval expected between submission of the EIA Statement and approval. In this case, the consultants submitted an SIA Statement to meet the regulatory requirements, never viewing the Statement as more than a requirement.

Under what circumstances is pre-decision monitoring appropriate? As Marshall and Scott (1983) suggest, the most appropriate cases for pre-decision monitoring are large-scale regional developments where there may be inadequate baseline and/or multiple projects over time. In these cases monitoring data for one become baseline for another, and the monitoring of acknowledged cumulative impacts is at issue.

In other words, monitoring does not necessarily have to be related to the production of an SIA Statement or to the regulatory approval process. Examples of SIA monitoring not related to the SIA Statement are available. For example, Ontario Hydro's monitoring of the impacts of the Bruce Nuclear Power Development began several years into the project!

Conclusion: SIA monitoring does not have to be related to the regulatory process. SIA monitoring can begin at any time during the regulatory process.

To develop a monitoring framework for each of pre- and post-decision monitoring, we would have to divide monitoring into phases related to the regulatory process, as if they differed by nature of their place in the process. We believe, however, that effective SIA monitoring begins with the involvement of all affected parties in shared decision making, from project conception through to project operation, i.e., in actual fact, front-end planning. Both pre- and post-decision SIA monitoring share important elements: high complexity, varying degrees of turbulence, inadequacies of baseline data, insufficient and often inappropriate methodology and, most importantly, need for validation by all affected parties.

Conclusion: We believe that our monitoring framework applies to both pre- and post-decision monitoring.

THE APPLICABILITY OF THE FRAMEWORK BEYOND THE THREE CASE STUDIES

We developed our framework through an extensive literature review and in-depth analysis of three cases. Questions will no doubt arise about its applicability to other situations, especially since two of the case studies deal with coal-fired power stations.

The rudiments of our framework began with work on the Huntly Monitoring Project in 1980. At that time, six cases were tested. Over the years the framework has been refined and informally tested as situations presented themselves. While the framework has been modified with new data, the general triadic model holds up very well across a variety of cases: hydro-electric dams, nuclear facilities, and water management projects. From the framework it is obvious that project type is not the major issue, for although the nature of the project and of the community will vary, the idea that monitoring involves a monitoring plan, process management, and an objective is generic.

What happens to the framework when more contentious issues are involved, for example, those affecting native peoples whose value systems and lifestyles differ from those of mainstream Canadians, or situations involving risk and safety, such as nuclear and/or hazardous waste facilities? We do not see the framework as requiring modification to accommodate such issues, because monitoring under those circumstances still requires a monitoring plan, process management, and an objective.

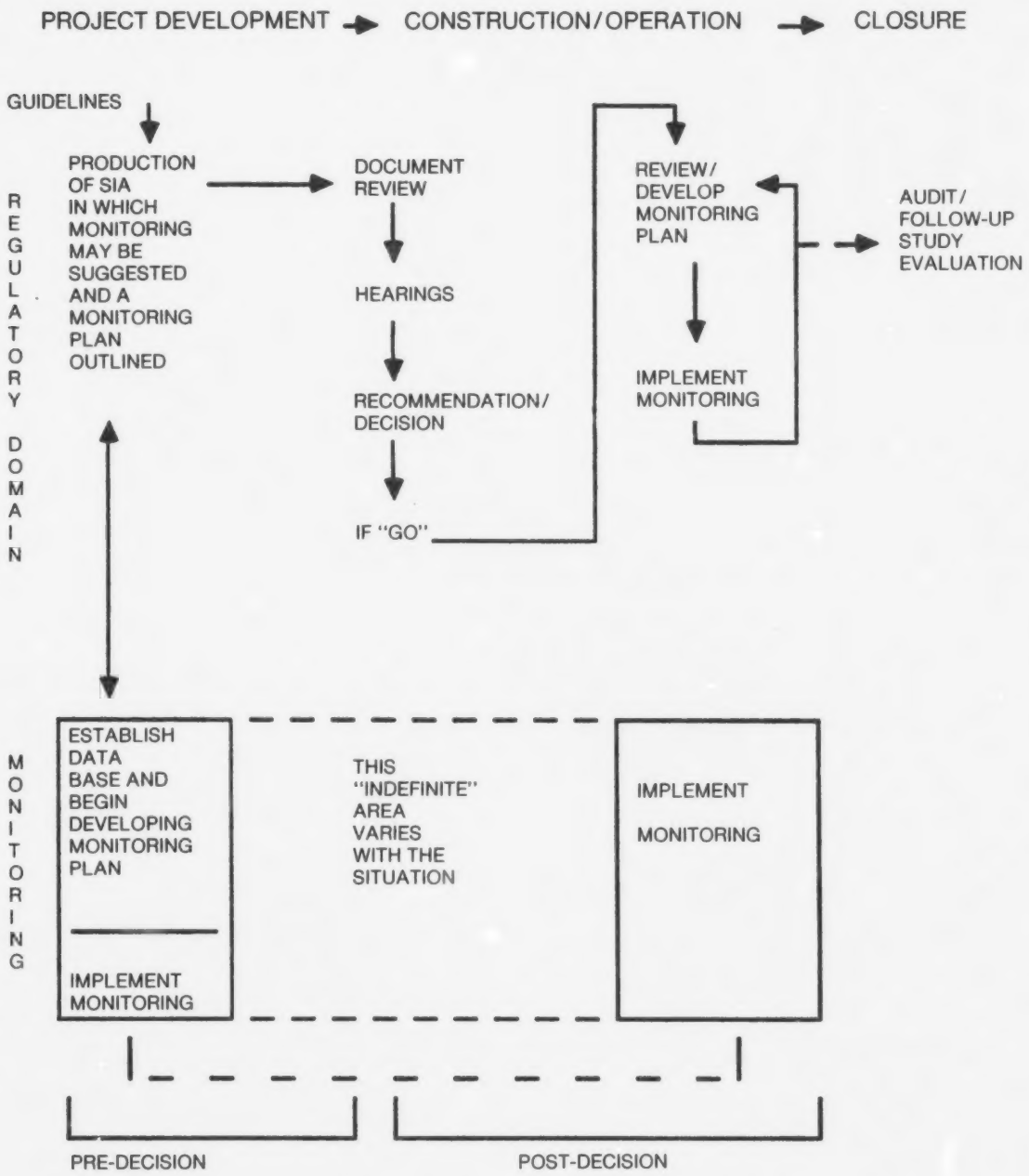


Figure 5. Monitoring in a Regulatory Context

Factors that are exacerbated in these situations already exist in SIA monitoring: ignorance, gaps in data, inappropriate methodology, lack of shared information, value clashes, turbulence and uncertainty, high complexity, and pressure for action or change. These, in turn, lead to a re-emphasis of the need for process management; the issues of inclusion, receptivity and commitment arise. The challenge is to develop a process of continual involvement in a complex and uncertain situation, something most monitoring exercises must face.

Thus we do not believe that situations beyond our case studies bring to the fore a new set of circumstances which the framework cannot handle.

THE APPLICABILITY OF THE FRAMEWORK TO THE TECHNICAL AND SOCIOPOLITICAL PARADIGMS OF SIA

There are two paradigms in SIA: technical and sociopolitical. Lang and Armour (1980:113-121) describe the differences between the two. The technical paradigm focuses on the production of SIA studies that are objective, and to the extent possible, scientific and quantified. A basic assumption of this paradigm is that better information results in better decisions; it is, therefore, associated with the decision maker. The sociopolitical paradigm focuses on the process by which social impacts are assessed; it is associated with community development and public participation. A basic assumption of this paradigm is that an open, participative process results in better decisions.

While the SIA literature acknowledges that attention must be paid to both process (sociopolitical aspects) and product (technical aspects), its two dominant paradigms — sociopolitical and technical — are considered irreconcilable. The implication is that we can either have a highly consultative process or a rigorous, professionally directed product. The current resolution is to have a bit of both: a professionally prepared SIA Statement, perhaps with a touch of public participation on the side, followed by public hearings.

Situations involving native peoples or risk and safety tend to be more successfully handled by the sociopolitical paradigm, with the technical paradigm playing a less significant role than usual. The Berger Inquiry and the siting of a hazardous waste facility in Alberta are examples.

The siting of Alberta's hazardous waste treatment and disposal facility at Swan Hills was based on the assumption that siting was largely a sociopolitical issue, with an important technical component. The site was found after a province-wide search using two criteria: environmental and social acceptability. The former was determined by constraint mapping focusing on site elimination *not* selection, and by detailed hydrogeologic studies; the latter, political acceptability, was determined by plebiscite. Both were linked by a process whereby constraint mapping was conducted only at the invitation of a local authority and the results delivered in a highly public and consultative way. Over 50 such invitations were received. Finding a site for the facility was a highly complex, volatile and arduous task, but two sites were identified which met both criteria.

Other situations seem, at least on the surface, amenable to a more dominant technical approach, perhaps with some public participation "on the side." However, if we look at the Keephills and Atikokan cases (the former highly consultative and socio-political, the latter based on the technical paradigm) some relevant findings are apparent. Over time both became more process-oriented. Both find the need for shared and sometimes highly technical information, yet interviewees in each case stress that qualitative data and community context are essential. Equity is at issue in both because in some respects interviewees feel they are playing a game well but with a stacked deck: at Keephills because of the legislation, and at Atikokan because of differences in planning values and in understanding the implications of the Agreement. We do not believe these similarities exist because both cases are coal-fired power stations; similar aspects have been noted by Leistritz (pers. com.) and Gilmore (pers. com.) on other project types. Discussions with SIA monitors and practitioners over the years lead us to believe that, at least in monitoring, the difference between the sociopolitical and technical paradigms becomes fuzzy; and that the fuzzier it gets, the more effective the monitoring is.

The two paradigms can be reconciled if we consider the technical as a subset of the sociopolitical: as that version of the truth put forward by scientific and professional interests. Obviously this is more easily said than done, but there are examples to show that it can be accomplished.

Conclusion: Our three case studies suggest that monitoring ascribes in practice to the sociopolitical paradigm, even when it tries to be rigorous and scientific, largely because of the continued presence and intervention of multiple parties-at-interest. Many of these have little direct knowledge of, or interest in, scientific rigour and the technical paradigm.

THE ISSUE OF LINKAGES BETWEEN EIA AND SIA MONITORING

We have examined how SIA and biophysical or EIA monitoring processes might be more closely linked. As this is a separate topic, and deserves more attention than we can attempt in this project, we have provided background material in Appendix B. We believe linkage is an issue. On the one hand it is embedded in several currently relevant issues in EIA and SIA; on the other hand it is not recognized as a priority within the impact assessment community. Our analysis, therefore, is only a beginning.

In this section we will first look at relevant information from the literature concerning linkages between SIA and the biophysical sciences. Much of our understanding of the issues comes from the literature on interdisciplinary research, which contains analyses of environmental programs. Next we will reference some of the work that supports the need for linkages. Following this, a brief description of one attempt within a major

research program will be given. Finally, we will identify some factors we think are important for creating linkages, and suggest areas where linkages can be explored.

Linkage Issues

A major difficulty in creating linkages is rooted in the structure of science itself; and many SIA and biophysical practitioners and researchers are a part of the scientific community. Although attempts to bring the two fields together have been made (e.g., International Association for Impact Assessment (IAIA)), most of the work reported in the literature is in either one field or the other. Presentations at the 1985 IAIA conference in Calgary involved little integration of the fields. The Follow-up/Audit conference was dedicated essentially to biophysical issues.

The field of interdisciplinary research (IR) has been a major source in developing our understanding of interdisciplinary practice; and EIA is an interdisciplinary practice. Although the IR field is too broad to explore here, some references should be mentioned. MacDonald (1982a) reviewed the literature on IR teams, and the most recent book by Chubin *et al.* (1985) explores a range of IR issues. Several authors have reported on their experiences in environmental programs (Burdge and Opryszek 1983; diCastri 1976; diCastri *et al.* 1980; Bella and Williamson 1977; McEvoy 1972). The Man and the Biosphere (MAB) Program also recognized the need to integrate natural and social sciences (UNESCO 1974). What are some of the difficulties encountered?

MacDonald (1982a) suggests several factors are critical to effective functioning of IR teams. Team performance is affected by three main factors: leadership style; team characteristics, especially team age, size and stability; and task characteristics, especially complexity, urgency, and predictability. Problems are also evident in three main areas: differences in the disciplines (suitable methods may not exist to integrate the various disciplines); communication difficulties and conflict due to disciplinary differences, personality, status, emotions, and individual skills; and the organizational structure of the team (a traditional university structure subverts the development of interdisciplinary teams).

Recent research in learning theory points to some fundamental issues inherent in the structuring of our knowledge fields, and how these affect individuals who enter various disciplines. Wolfe and Kolb (1984) suggest most individuals develop learning styles that emphasize some learning abilities over others. They suggest there are four types — converger, diverger, assimilator, and accommodator. Convergers are relatively unemotional, preferring to deal with things rather than people; they tend to be applied scientists and engineers. Divergers are interested in people, tend to be imaginative and emotional; they tend to be social scientists. Assimilators tend to be less interested in people and more concerned about abstract concepts; for example, natural scientists. Accommodators tend to be people in the social professions; educators, lawyers, and social workers. These groupings are based on a major study of faculty and graduate students in the United States.

Associated with these four major groupings of learning styles are fields of knowledge. What constitutes valid knowledge differs widely, in how knowledge is reported, in inquiry methods, or in criteria for evaluation. This research has not appeared in the environmental literature, yet it exposes fundamental differences which will have a bearing on linking EIA and SIA monitoring systems. The research indicates that people who attempt linkages face not only the usual methodological differences, but differences in their personal frames of reference that may prevent them from collaborating.

Additional insight is provided by the literature on interdisciplinary environmental research. McEvoy (1972:204-205), in discussing a multidisciplinary research project on environmental problems in the Lake Tahoe Basin, noted: "Between the social and biophysical subsystems of the type with which we have been dealing at Lake Tahoe there are few common metrics, fewer common methodologies for their joint study and still fewer persons trained in both types of systems. A theory of integration is almost totally absent. . . The first requirement of integration is the existence of a framework into which diverse data of these types can be arrayed to make conceptual sense." Burdge and Opryszek (1983) talk about "mixing apples and oranges" in their analysis of the Lake Shelbyville reservoir impact study. In this case, the scientists — biologists, economists, engineers, planners and sociologists — eventually formed four teams: social, economic, biological, and integrative. As the authors indicate, major problems were encountered: individuals' hidden objectives threatened to subvert parts of the project; people did not understand what it cost to do research in other disciplines; the divergent nature of data bases of each discipline complicated co-operative efforts; biologists tended to gather data of local, i.e., site-specific, rather than general, interest; sociologists took a "shotgun" approach to impact assessment; and biophysical and social scientists suffered from data incompatibility, since they did not understand each other's needs.

Integrated Assessments

Our review of the Canadian literature does not indicate that linkage is a major issue. We have little evidence of it being attempted to any degree. A brief overview of recent EIA statements submitted to Alberta Environment shows they continue to separate EIA and SIA. The Hibernia Development Project (1985) EIA is separated into SIA and EIA components; and the Norman Wells pipeline monitoring programs are additional examples of the lack of linkages. Yet there is a recognized need for some form of integrated impact assessment (IIA).

Kutay *et al.* (1983) suggest system simulations can be useful in delineating impacts, but that these models have to be broadened to include social and institutional components. They also recognize the human factor involved, identifying the need for assessors and managers to have interdisciplinary training, and, where the assessment is a part of the management process, pointing out that the people involved must have decision-making skills that can be applied to resolve conflicts. Harman (1983:19), however, is not as optimistic about the viability of integration. As he points out, ". . . most of conven-

tional science is reductionistic in its methods and its explanations, whereas IIA is essentially holistic."

Erickson (1979:343), one of the authors who has overviewed the assessment process from a systems perspective, supports the need to consider ecosystems and social systems when studying impacts. He suggests that assessments should consider the total environment, which includes biotic, abiotic, and ecological components, as well as personal, interpersonal, organizational, and other institutional components of human life. "From a total environmental perspective, it is absolutely necessary to assume that there will be indirect, social consequences to most if not all direct impacts on the physical environment and that there will be indirect, physical consequences to most if not all direct impacts on the social environment."

While impact assessments focus on the biophysical environment, Conover (1985) suggests the same approach taken in biophysical assessments should apply to socio-economic environmental effects monitoring. She suggests EIA and SIA will need to be better integrated in the future, and monitoring will be required to test hypotheses and impact predictions in both areas.

Beanlands and Duinker (1983:18) suggest that if assessments are to fit into an ecological framework, it will first be necessary to apply the concept of social scoping. Social scoping is defined as ". . . a very early activity in an impact assessment in which an attempt is made to identify the attributes or components of the environment for which there is public or professional concern, or both, and to which the assessment should primarily be addressed." Social scoping is often expressed in terms of the plant and animal species perceived as being important to society, as identified through social, cultural, economic, aesthetic and scientific values. This is followed by ecological scoping, ". . . an exploration of the possibilities for studying and predicting effects of a planned action on the attributes so defined." Ecological scoping focuses on what can be accomplished in the scientific realm. Finally, each of the environmental attributes or components identified in the social scoping is referred to as a valued ecosystem component. Thus, in brief, it is a sociopolitical process which identifies the valued components in an impact assessment.

Beanlands and Duinker did not consider SIA in their work, but focused on bringing ecological thinking into biophysical impact analysis. Their analysis is relevant to the issue of linkages, however, as it supports the need to begin identifying issues early in the assessment process, and to involve the affected public in social scoping. Following this initial stage, the scientific community needs to forge the links identified in the public's mind, and develop the methodologies to study the related issues. What Beanlands and Duinker do not address, and could not be expected to address in their study, are the process issues associated with the scoping exercise, the monitoring which follows, how the "non-ecological" issues are to be handled, and how integration is to occur. Our analysis indicates that process must be an integral component of assessment and monitoring, and that it requires as much attention as the methodological issues, normally the only ones considered by the scientist and practitioners.

AOSERP — Attempting Integration

In one of our case studies (Appendix A, Case 3) we looked at the Human System within the Alberta Oil Sands Environmental Research Program (AOSERP). One of AOSERP's original objectives was "to co-ordinate the projects within the Program so as to provide an interdisciplinary study of environmental problems" (Schedule A, Canada-Alberta Agreement, in Smith (1981)).

Several attempts have been made to develop an integrative framework for the program, one of which involved Adaptive Environmental Assessment and Management (AEAM) (Holling 1978). Using this method, consultants attempted to develop linkages within and between the four systems — air, water, land and human. The integrative links developed in this project did not last longer than the project itself.

Everitt (1983:121) described his experiences as one of the consultants conducting the exercise: "The reason for this failure [i.e., for the results of the AEAM exercises having little impact on decision making] seem clear. The initial client, the Director of AOSERP, retired in the midst of the project, passing responsibility for the entire program to the Chairman of the Research Secretariat who provided little direction until he resigned in early 1981. The hard lesson that we learned here is that without the key individual who becomes a critical partner with the environmental professional there is little hope of reaching the decision maker."

This quote has made us very aware of the different conclusions one can draw from a case study because of differences in information base, perspective and priorities. Everitt expresses his viewpoint from the perspective of an individual who saw the AEAM modelling exercise as central to success in integration, and the director as the key to reaching the decision maker, and, implicitly, to influencing decisions.

The AEAM exercise did not achieve the expectations of the consultants. Both directors also had high expectations for the modelling exercise.

From our perspective, (one of us was the aforementioned chairman who became the director) five other factors are important to consider:

- The scientists strongly resisted and reluctantly participated in the exercise to integrate their disciplines. The project began four years into the program; territories had already been staked out by the researchers.

- The consultant team was inexperienced in managing human dynamics and the resistance of scientists in the workshops was difficult to handle.

- The limits of the "black-box", computer-driven model disappointed some participants. For example, Edwards (pers. com.) states that for the human system, the modelling results of projected growth scenarios for Fort McMurray were no different than any SIA computer modelling results. However, human systems requests to link air pollution and health were not handled by the AEAM model.

- While the AEAM exercise was under way, internal conflict and staff turn-over were generally very high due to the merger of the two research groups, AOSERP and the Research Secretariat, thereby reducing the possibility of program staff giving the positive support needed in establishing linkages.

- Several other program priorities took precedence as a result of the merger (filling vacancies, attempting to assure the permanency of the positions and the continuation of the program). The amount of time and energy the director could devote to implementing the results, even if they had been acceptable, was limited and of relatively low priority when the survival of the organization was at stake.

There have been subsequent attempts at integration. In 1980-81, scientists tried to integrate different approaches in developing ecological monitoring methodologies, but the effort was plagued by "people issues" (Sims, pers. com.). Some progress has been made in two areas: atmospheric scientists and biologists have collaborated to study effects of air pollution on the forest ecosystem, and aquatic biologists have been researching problems affecting the local fishery as a result of contaminants in the Athabasca River. Other linkages have not yet been established.

Conclusion: Creating linkages between SIA and biophysical monitoring processes will face formidable tasks inherent in scientific methodologies and in the processes needed to bring the scientists or practitioners together. In many situations, the required integrating methodologies will not have been developed. In many situations, the people involved will not be favourably predisposed and will not have the process skills required to manage the interpersonal issues. In some situations, higher priority issues will override the integration. We have little evidence of cases in Canada which have successfully integrated SIA and EIA concerns (one exception being the siting of Alberta's hazardous waste management treatment and disposal facility at Swan Hills).

Linkage Barriers and Conditions

Based on a brief literature review and our own experience, we suggest that there are several barriers to linkage. They are largely institutional, such as the lack of incentive and of opportunity to perform; and methodological, such as lack of appropriate methodologies. We believe that institutional factors are the major barrier to achieving linkages. Our reasons for this belief are the following:

- Integrated monitoring or integrated impact assessment is not a regulatory requirement. Hence the proliferation of separate SIA and EIA components because agencies have accepted multidisciplinarity. (This does not mean that integration is always necessary.)

- As a result, the private sector, including consulting firms, tends to have separate SIA and EIA groups, in line with the practice of producing multidisciplinary reports.

- In general, the private sector lacks the incentive to achieve linkages because they are expensive and there is no reward when linkages are not required. Some individuals with a personal commitment to interdisciplinary approaches have provided project funds, but they are the exception rather than the rule.

- The EIA/SIA team is usually assembled on a project-by-project basis. Long-term continuity across projects, essential to group cohesiveness, occurs by accident rather than by design.

- Many social and biophysical scientists lack the process skills essential to group design and management. Many do not see these skills as important. Seldom are groups selected for more than technical expertise; seldom are skilled, credible facilitators or process experts part of the team.

- The scientific personality tends to handle conflict by withdrawing from it (Miller 1984). However, without conflict, major value issues cannot be raised and examined. Conflict is an essential part of group process — not something to be avoided!

- There is a lack of personnel. The monodisciplinary orientation of most SIA/EIA scientists and practitioners will be a barrier to linkage as long as they continue to perceive their strongest affiliations to be to their discipline, that is, as long as transcending the discipline is seen as a loss of status. People who have interdisciplinary or trans-disciplinary training are in short supply and thus may not accept the lower status, lower paying positions that may be available in the field.

- Both SIA and EIA practitioners lack the confidence in their own sphere of expertise to be able to interact with "the other side" without being defensive. While trying to improve the EIA process, the biophysical community is still identifying closely with itself. The situation is similar in the SIA community where attention is directed inward to the SIA process, usually to the exclusion of the biophysical field. Neither group is particularly receptive to the other, often viewing the other party as elitist, narrow, and somewhat inferior. This view is confirmed in discussions with those in the dominant power positions in environmental organizations, biophysical scientists. Should linkages become a major issue, the biophysical scientists may redefine SIA to consist solely of the linkage areas, thereby excluding about 90% of the field. This threat of annihilation of the field is very real.

- The scientific elitism inherent in the technical paradigm has restricted the involvement of other parties-at-interest, because they are seen to be less legitimate or of limited utility to the conduct of professional activities. A trend toward further inclusion of these parties is evident. For example, Beanlands and Duinker (1983) suggest social scoping, Grima *et al.* (1985) state the importance of the public in risk management, while participants in the Follow-up/Audit of Environmental Assessment Results Conference, October 1985 in Banff, Alberta, and Millard (1985) have called for public involvement in the process. However, what they suggest as the public's role, what organizations may accept as the public's role, and what "the public" may view as its role, are likely to be quite different.

The issue of biophysical linkages can be viewed in two ways: as a quest for interdisciplinarity within the technical paradigm, that is, SIA and EIA practitioners (both of the technical paradigm) working on interdisciplinarity; or as a subset of the issue of resolving the sociopolitical and technical paradigms. In either case, we believe that the barriers listed above will present themselves. Further discussion of this concept is beyond the scope of this report.

We have only highlighted the issues we see as barriers to establishing linkages. Doubtless others exist, and methodological barriers will also be found. These should be examined more fully in future research, if the process of facilitating linkages is to be improved.

Our analysis has identified several issues in EIA, and has indicated difficulties concerning linkages. We have not focused on SIA, since the rest of the report treats this extensively. The main point is that many issues exist in both fields, and the issue of monitoring linkages does not appear to be a high priority, judging from the lack of literature. This does not negate the fact that it will be an important component in successful impact assessments, and that more attention must be paid to improving our ability to conduct integrated monitoring programs on resource projects.

Some conditions are important to linking the two fields, and we have identified five important ones here.

- The scientists and practitioners involved must be motivated to work together.
- The methodology must not be insurmountable. It must have been developed and available in monitoring for impact management, due to the short time frame usually available; or it may need to be developed in monitoring for prediction, and the time needed for this must be recognized.
- Individuals involved need to recognize the potential for conflict, and use it constructively, rather than attempting to ignore it. In many cases, a skilled, credible facilitator is required.
- Individuals need to understand the requirements of their colleagues, and have suitable skills to work together.
- Organizations sponsoring or requiring integrated monitoring or assessments must provide sufficient support and incentives; the cost in time and resources may be greater than for mono- or multidisciplinary approaches.

Linkage Areas

We have not done a major search of the literature for examples of socio-economic and biophysical integration, as linkages are a small component of our main project. We have mentioned the experiences of McEvoy (1972) at Lake Tahoe, and Burdge and Opryszek (1983) at Lake Shelbyville, where biologists, economists, sociologists, and engineers worked together, but these reports do not indicate the specific linkages. We can suggest potential areas, however, by combining some literature examples and our own knowledge and experience with assessment and monitoring.

We believe many linkages become evident in the initial stages of assessment, that is, during scoping exercises, public hearings or meetings, or when regulatory agencies identify issues an EIA must address. Judging from the literature, a review of assessments, and our personal knowledge, the potential linkages are not captured in the monitoring programs, if and when such programs are implemented.

Beanlands and Duinker (1983:44), discussing social importance and valued ecosystems, identify several areas where linkages may be developed: "effects on physical and biotic resources valued by man for commercial, recreational or aesthetic purposes." Six areas where this social valuing is prominent are: human health and safety; commercial species (plant and animal); species with a major recreational or aesthetic importance; rare or endangered species; protection of species habitat; and imbalances between supply and demand of species in a local, regional and national context.

As mentioned above, while these may be obvious linkage points, we have little evidence that links are in fact established in practice. We have no significant references or knowledge of these linkages in an SIA/EIA monitoring context, with the exception of the Keephills case. Interestingly enough, community members, that is "the public" have no difficulty with the concept of linkages. Their concerns transcend disciplinary, EIA, or SIA boundaries.

Potential general areas are identified below. We do not try to identify disciplinary aspects of the linkage, because this will vary depending on the specific circumstances of the project. We do not list these areas in any order of importance.

CHANGES TO RESOURCE-BASED ECONOMIES

Fishing, hunting, and trapping are important to certain segments of Canadian society, especially native peoples. Impacts on resource-based economies are more than economic; they can permeate all aspects of individual and community lifestyle, as shown for the community on Southern Indian Lake, mentioned in the Environmental Audits section of Appendix B. Many resource developments disturb agricultural practices, as in the Keephills case. Not only is the biophysical environment disturbed, but social and economic conditions are changed. Conflicts resulting from competing resource uses require resolution.

ENVIRONMENTAL HEALTH

Air pollution, exposure to toxic substances, water pollution, and other conditions which expose people to potentially harmful substances, require a broad range of disciplines to assess impact. These have psycho-social components as well (see Edelstein 1982). Somers (1982) discusses Canadian cases of integrated monitoring to assess health effects of pollutants on human populations.

RECREATION

The use of the environment for consumptive and nonconsumptive recreation, including aesthetic enjoyment, is an important consideration in some projects. Generally the interest is in

protecting valued species, either those in an endangered state, or those that should be maintained at a certain level for recreational pursuits, such as fish stocks, or for protecting an environmental state, such as the natural wilderness. In some cases, this requires the resolution of conflicting uses, for example hunting for sport versus hunting for food.

PERCEPTIONS AND ATTITUDES

One area of current concern where perception and attitude are important is the topic of risk and safety. It is not itself an environmental component, but it is an approach being introduced to analyse environmental conditions. Risk management, as a general tool, will require integration of SIA and EIA interest among others, as for example legal, engineering, or health, if risks are to be assessed, understood, and managed.

CHAPTER 7: RECOMMENDATIONS

INTRODUCTION

In this chapter we offer 10 recommendations:

- to strengthen the immediate contribution of impact management monitoring in effective impact management;
- to strengthen the contribution of SIA monitoring in improving predictive analysis over the longer term;
- to indicate centres of responsibility for implementing SIA monitoring programs; and
- to suggest how social and biophysical monitoring processes might be more closely linked to produce an integrated approach to project implementation.

As well, we define issues that require further research, explaining the rationale for this research and outlining the required scope of analysis.

RECOMMENDATIONS TO STRENGTHEN THE IMMEDIATE CONTRIBUTION OF MONITORING IN EFFECTIVE IMPACT MANAGEMENT

1. *Implementing the Framework*: We believe that the premises of our framework could be used as a checklist, to spot weaknesses or gaps in a monitoring program under development. Specific premises from the framework should be incorporated into such programs. For example, Premise 13 implies that to ensure results are useful in impact management monitoring, monitors should involve the users of the monitoring data directly, at the very beginning of monitoring and throughout the process, to design the program, to access data, and to understand the meaning or implications of the data.

2. *Clear Terms of Reference*: We have argued that pursuing the objectives of impact management monitoring and prediction monitoring as part of the same monitoring project hampers effectiveness. Therefore, governments should not state both objectives in the same terms of reference for their monitoring programs and, likewise, monitoring sponsors should avoid trying to meet these two objectives simultaneously.

3. *Professional Development*: We describe the gap between theory and practice throughout this report. One way to bridge that gap is through professional development. Practitioners need to exchange experiences, learn suitable methodologies and process skills, and have access to professional expertise. Our recommendation is to prepare a *short* practitioners handbook on monitoring, based on the conclusions of this report. The handbook would include general guidelines on implementing monitoring programs and the issues associated with them, along with a "yellow pages" type of reference list. Holding workshops for practitioners, using the handbook as a basis for the workshop content, would be a cost-effective way of quickly improving the state of the practice.

RECOMMENDATIONS TO STRENGTHEN THE CONTRIBUTION OF SIA MONITORING IN IMPROVING PREDICTIVE ANALYSIS OVER THE LONGER TERM

4. *A Monitoring Data Base*: In Chapter 1, we stated that unverified predictions made in previous SIA Statements are the current major source of SIA Statement predictions. This current practice flourishes because of the lack of alternatives. Little empirical information is available and what exists is either proprietary or not widely distributed. Assessment of its quality is left to the reader. Predictive capability would improve considerably if there were empirical sources on which to draw. Therefore, we advocate establishing an empirical data base, that is, a monitoring and project follow-up data base similar to many of the other computer data bases available in the sciences. The data base should contain empirical results of project audits and of monitoring studies for future use, as well as literature reviews on particular variables, methodologies and/or project or community types. To ensure quality we suggest that material be screened for relevance and for adherence to professional standards. This type of screening is particularly important because the users will come from different disciplines and thus may not be able to distinguish quality work in all the fields which contribute to SIA.

RECOMMENDATIONS TO INDICATE CENTRES OF RESPONSIBILITY FOR IMPLEMENTING SIA MONITORING PROGRAMS

5. *Community Assistance*: Community members we talked with said that they need more financial and information resources in order to participate more fully in monitoring. Some are also concerned about being directly dependent on the proponent for funds or expertise. However, many parties-at-interest are concerned about ensuring representativeness and accountability of community members involved in monitoring. They do not want to allocate resources to members who "are not in good standing." The standard solution, total reliance on the local authority as the community representative, is insufficient, in our

opinion. We suggest that at the time of project approval, a fund be set aside for community use by the proponent, in a "blind trust" type of account (whose expenditures cannot be directly influenced by a proponent's wishes); a policy on who is allowed access to these funds, and for what reasons, should be established by proponent-community agreement.

6. *Governments' Roles*: governments' roles in improving monitoring practices in Canada should include:

   - providing regulatory guidance by:

     —developing requirements for SIA monitoring,

     —developing requirements that the proponent involve the community,

     —requiring follow-up on projects to identify the actual outcomes compared to SIA predictions — by implication, this is to test the utility of the SIA, and to provide information about the predictive capability of the practice, and

     —ensuring that these measures are actually taken;

   - supporting long-term research and manpower development. In our opinion, SIA general, and Canadian SIA in particular, suffers from too few environmental social scientists and the resultant environmental social science research that is the foundation for improvements in practice. For example, our terms of reference required us to review SIA monitoring in Canada. Had we confined ourselves to that literature alone, our report would be very short and our framework, skimpy. This suggests a lack of research and researchers in this area. At the present time, research and development in this area is haphazard. Increased opportunity for training and research should be encouraged, particularly by funding agencies.

RECOMMENDATIONS TO SUGGEST HOW MONITORING PROCESSES MIGHT BE MORE CLOSELY LINKED FOR AN INTEGRATED APPROACH TO PROJECT IMPLEMENTATION

7. *Governments' Roles*: Governments' roles in improving the integration of social and biophysical monitoring processes should include:

   - providing regulatory guidance by:

     —developing requirements for integrating social and biophysical monitoring,

     —developing requirements that the proponent involve the community, since members seems to have less difficulty identifying areas for integration, and

     —ensuring that these measures are actually taken;

   - supporting long-term research and manpower development. In our opinion, Canada suffers from too few interdisciplinary or transdisciplinary and social scientists, and lacks the resultant research that is the foundation for improvements in practice. Increased opportunity for training and research should be encouraged, particularly by funding agencies.

8. *In-house Staff*: In both the public and private sector, agencies with environmental and/or impact assessment responsibilities need to hire socio-environmental staff, and ensure they are part of an integrated unit in the agency. Separation, and hiring of SIA professionals into positions of a lower status than those in the biophysical groups, will only continue the historical situation of elitism, non-acceptance of social issues, and separate SIA/EIA monitoring or assessments. However, the concern remains that SIA will then be reinterpreted in EIA terms, thereby excluding much of the SIA field.

ISSUES THAT REQUIRE FURTHER RESEARCH

9. *Methodologies for Social and Biophysical Linkages*: Research and pilot projects are needed on the linkage areas identified in this report and to identify other linkage areas. Previous attempts, and their success or failure, need to be better understood, before forcing linkages in monitoring programs. We recommend beginning with an interdisciplinary team that would review the suitability of available methodologies for social and biophysical linkages. If promising methodologies are found, they should be tested in pilot projects.

10. *Improving the Practice of Process Management*: We suggest that, while process management is important for effective monitoring, it is often a neglected, or poorly implemented, element. Given that major variables affecting group process are well documented in the literature, a pilot project should be undertaken to test the most promising process management methods, using "well-designed" groups of researchers/practitioners, community members, etc., and process facilitators. The process management methods tested should be limited to those that the evaluation literature has shown are effective. Government and industry need to collaborate in this activity, to ensure that actual field conditions exist for the pilot project(s).

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APPENDIX A

CASE STUDIES

INTRODUCTION

In this Appendix we look at the effectiveness of monitoring in three cases: the Keephills Power Project, the Atikokan Power Project, and the monitoring program inherent in the human system research of the Alberta Oil Sands Environmental Research Program (AOSERP).

Recognizing the scarcity of SIA monitoring projects in Canada, our criteria for case selection were based on administrative requirements:

- At least one case had to involve the use of impact management monitoring; while another must involve prediction monitoring, as specified in our project's terms of reference. The first two cases are examplec of impact management monitoring; the third, prediction.
- A preliminary assessment of likely impacts was undertaken for the first two cases. This was not possible for AOSERP owing to the newness of the technology and the relative lack of development of SIA regulatory guidelines at the time.
- The monitoring process had to be documented.
- The projects had to be recent enough so that key personnel were still available for interview.
- Significant barriers to data retrieval must not exist.

All the cases are associated with the energy "boom" and subsequent "bust." Each differs in its focus. The Keephills case is community- and proponent-driven, focusing on managing the decision process, from a symbolic interactionist perspective. (Symbolic interactionism is a sociological theory that considers the symbolic context, that is, value and belief systems, as the key to how each party interprets the actions of others.) The Atikokan case fits the SIA technical paradigm of impact management monitoring, and is proponent- and local authority-driven. The AOSERP case is government-driven and has an eclectic, comprehensive orientation, aiming for both prediction and impact management.

In the analysis of our cases we have imposed a structure based on the monitoring framework developed in the text. This creates a picture of the cases which may look ordered, but the reader is cautioned that in the real world events happen and decisions are made without reference to a model that an analyst has constructed. The effectiveness of monitoring in each project is determined by the extent to which monitoring objectives are met.

At Keephills, the community and company were reacting to a fast-moving situation, and with the involvement of a professional consulting team, developed an interactive process to resolve issues and involve the community in project-related decisions. No one consciously set objectives, although both groups had an idea of what they wanted to achieve. The formal monitoring program consisted of the Keephills surveys, although they have not been used by the company for impact management. In our analysis we have constructed objectives and used the framework to reach some conclusions. This construction and the conclusions have been discussed with the parties involved; the final analysis is a synthesis of several inputs.

At Atikokan, monitoring objectives were set by Ontario Hydro, and the monitoring program was based on a technical-planning model of monitoring. Since specific objectives had

Table A-1
Format for Case Studies

BACKGROUND
History of the Project
MANAGEMENT CONTEXT
Complexity and Uncertainty
THE MONITORING APPROACH
Scope
Collection and Analysis
Interpretation
Feedback
MANAGING THE PROCESS
Process of Analysis
Organizational Arrangement
Process Management Issues
Inclusion of the Parties-at-Interest
Receptivity
Commitment
ACHIEVEMENT OF OBJECTIVES
Objectives
Evaluating the Objectives

been set, we were able to evaluate the effectiveness of the program in meeting them. As with Keephills, we used the framework to analyse the case.

Finally, in the AOSERP Human System case, objectives were set and the case can be evaluated against them. The objectives, however, changed during the program. The last ones were written after the shape of the program became evident, and should be understood in that light. Using our monitoring framework to analyse the program, we are able to show that conditions were such that the objectives could not be achieved.

The format of our analysis is similar for each case study. This allows the reader to compare similar parameters of the framework across cases, and to note the different conditions that occurred. The format for the case studies is shown in Table A-1.

CASE 1: THE KEEPHILLS POWER PROJECT

BACKGROUND

Keephills is a farming community about 80 kilometres west of Edmonton. The name of the area comes from the hamlet of Keephills, which in 1975 consisted of four families, a school and a community centre. In 1976, Calgary Power proposed building an 800 megawatt power plant, seven kilometres north of the hamlet. Strip mining for the plant would eventually require about 90 square kilometres of land, including the hamlet. About 700 people lived in the area (based on the 1976 census of two enumeration districts). At the time of the proposal, Calgary Power had a power plant and mine 15 kilometres northwest of Keephills, and was, therefore, already a presence in the area.

(In 1982 Calgary Power changed its corporate name to TransAlta Utilities. For continuity, we will refer to "TransAlta" or "the company" in this case study.)

History of the Project

In 1974, TransAlta (Calgary Power) submitted an application to the Energy Resources Conservation Board (ERCB) to build a power plant in the Camrose-Ryley area, southeast of Edmonton. The region has prime agricultural land, and although it does not have a large population, it is a prosperous area. TransAlta developed its plans for the mine site and power plant, and announced them to the public without consultation. According to the company, the land would be mined, and would then be reclaimed to its former productivity.

Intense opposition to the company's developed plans in the community. Local groups formed to oppose the company; provincial environmental groups and experts became involved, disputing the claim that enough was known to restore the land's productivity. Disruption of the local rural population also became an issue. The opposition continued during 1974-76, and culminated in August 1976, when the Government of Alberta announced that plans for a mine and power plant would not be approved. At the same time, the Government released a new coal development policy, which required public disclosure of projects in the early stages of planning (formerly disclosure occurred only when plans were nearly completed).

Because of the energy boom and the projected need for power, TransAlta moved quickly to find another site for the power plant. An area of vast coal reserves in the area 80 kilometres west of Edmonton came under consideration. The company began to contact the residents of Keephills and surrounding region in October 1976, two months after the Government's decision, to advise them that plans were being developed for a power plant in the area. At the same time, HERA Consulting Ltd. was hired by TransAlta to act on its behalf during interactions with the community. HERA, which consisted of four social scientists from the University of Calgary, played a principal role in the process: the consultants acted in a dual capacity, as advisors to the company, which included preparing the SIA; and as advisors to the community, helping it organize and facilitating its responses to the company. All consulting costs were borne by the company, which has continued to pay for consulting activities over the years.

At the same time that the company was contacting the community, Alberta Environment began to interact with residents. Public participation staff from the department provided support and advice on community participation in the ERCB public hearing process.

The company also contacted individual landowners living near the proposed site. Company landmen, who acted as purchasing agents, wanted to buy land that would be mined or occupied by the power plant and its related facilities. This activity went on independantly of the community involvement process (which involved HERA and the planning group in the company). By November 1976 the formal application for the power plant was submitted to the ERCB; this occurred three months after the Government's decision on the previous project.

In its consulting role, HERA suggested that the community, the company, and the Government of Alberta form a committee to represent their interests. The company indicated in its EIA that it would form such a committee upon project approval. The residents, however, did not wait for the joint committee to be formed. In January 1977, the community formed the Committee on Keephills Environment (COKE), and proceeded to organize its approach to intervention in the public hearings. This was "the first community advisory group established in Alberta to advise on a specific resource development project" (Prokop 1983:7).

TransAlta held its first public disclosure meeting with the community that month, as required by the new coal policy. Several managers from the company were there to explain project plans. Concern for the hamlet arose, as it would be stripmined to provide coal for the plant. Although few people resided in the hamlet, it was the focal point of the region, containing a school and community centre, and was thus the key element in maintaining the area's sense of community. When it became evident that preserving community cohesion was the key issue, a community vice-president committed TransAlta "on the spot" to pay for moving the hamlet to a new location. It was estimated that the move would cost less than $1 million.

COKE participated in public hearings held by the ERCB in March. It raised a number of issues, the two main ones being

land acquisition and hamlet relocation, but its submission was generally supportive of the proposed plant. The company also formally committed itself to relocating the hamlet. In August the ERCB recommended that the project proceed. (The ERCB does not make a final decision on these projects; it submits recommendations to the Government of Alberta for a decision.) It also recommended that a community-company-government committee be set up to consider mutual interests. The Government approved the project in December. The approval also required the company to form the three-party committee, calling it the Keephills Power Project Steering Committee (referred to as the Steering Committee in this report).

During 1977 and 1978 COKE was very active as the community representative. Its nine-member board of directors and numerous other volunteers met frequently and developed the community's strategy for responding to issues. COKE became involved in the land acquisition issue, advising individual residents on their interactions with the company. COKE also interacted with the company on hamlet relocation (a process which began in 1978 and lasted until 1982). The Steering Committee met only twice in 1978, once in January, and again in December, after community residents approached the Government about the committee's inactivity. HERA remained an active participant in the public involvement process, and carried out the first social impact survey of the community. (Called the Keephills Survey, it was the first of three to be taken every three years (HERA Consulting Ltd. 1978, 1982, 1985). Community residents were involved in designing each survey.) Meanwhile, the company was proceeding with plant construction.

Because of the continuing energy boom in Alberta, TransAlta developed plans for an expansion of the Keephills power plant. The company submitted its expansion application to the ERCB in October 1979, proposing to double plant capacity by 1985-86. COKE participated in the ERCB January 1980 hearing and was supportive of the application. In May, the ERCB announced it was deferring approval. This decision had nothing to do with community issues, but the ERCB had to decide which power plants should be built, since more than one was being proposed at the time. The ERCB also commented on hamlet relocation, indicating that since mining would not reach the hamlet for several years, it saw no immediate need for relocation. The company did, however, decide to continue with relocation. They preferred to do so in the near future, since plans for relocation were being developed.

HERA carried out Keephills Survey II in the summer of 1981. Negotiations and plans were finally completed for hamlet relocation, and construction of a new hamlet began eight kilometres east of the old one.

In February 1982, the ERCB denied TransAlta's application for expansion at Keephills, as power needs were being reduced with the onset of the recession. Construction of the first plant was completed, and it began operation in 1983. In October the new hamlet was officially opened by the company and the community, and residents began to move into the new location. In addition to residential lots, the new hamlet contained a new school and community centre. The final cost of the hamlet has been estimated at about $4 million.

Dialogue has continued between the community and the company since 1982. COKE has succeeded in developing a land purchase and land lease policy with the company, as a means to ensure equitable treatment for individuals who either sell land to or lease it from the company. COKE continues to meet on a monthly basis, and is now turning its attention to environmental issues, such as changes in water wells (residents are concerned that mining is affecting the groundwater regime), coal dust, and land reclamation. In 1984, HERA conducted Keephills Survey III; the results of all three surveys are being reviewed and will be published. Although the plant has not been expanded to date, TransAlta continues to plan for an expansion, possibly within five years.

MANAGEMENT CONTEXT

Complexity and Uncertainty

The community was thrown into a highly turbulent situation with the announcement of a power project. Within four months of submission of the EIA, residents had to organize themselves and prepare a submission to the ERCB. The Government of Alberta, the Electric Utilities Planning Council, and the power companies wanted a quick decision because of the energy boom and projected need for power.

Within three years of the original proposal, the community learned that a plant expansion was being proposed, and residents once again participated in hearings. But the expansion did not proceed as expected, for two reasons. In the rush to increase power production in the province, several energy projects were being proposed, and the ERCB was trying to determine the best development schedule; the Keephills expansion was to be a part of this schedule. Subsequently, in 1981, the entire Canadian economy began a recessionary period; this reduced pressure for more power and put the expansion on hold indefinitely. This unanticipated circumstance gave the community time to adjust to the project.

Over a six-year period, the community had to deal with plant construction, land negotiations, hamlet relocation, and potential plant expansion. Major activities have not occurred since 1983, although the plant may expand in the future.

THE MONITORING APPROACH

Scope

Three bodies monitor the program: COKE, the Steering Committee, and the consultants who conducted the surveys.

Monitoring by the community is process-oriented and based on participant observation. Any reported concern is included for consideration. Issues have tended to be social; economic issues have concerned land acquisition and hamlet relocation, with little attention to employment, regional benefits, or project costs. Environmental issues have been minor, usually when people are directly affected, such as problems with wells.

The Steering Committee monitors concerns that are raised in its meetings. It has not developed any monitoring projects for data collection, but has taken the issues identified in its terms of reference as issues to be "monitored," although formal plans were not developed to follow them. These have been primarily hamlet relocation and activities related to land: acquisition, the mine, reclamation, highways, etc., and, infrequently, environmental or social studies. Economic issues, such as employment, regional benefits, or operating costs, have been almost nonexistent. Because of the sensitive nature of land transactions, the Steering Committee has not become involved in specific issues between the company and individuals.

The Keephills Surveys have been designed for data collection and research purposes by social scientists, consequently they can be considered as research instruments. The surveys are the only formal monitoring associated with the power project. The surveys have focused on three main issue areas: the sense of community felt by residents and personal impacts on them; residents participating in decision making and their perceptions of parties-at-interest; and demographics. The surveys have not included economic or workforce issues to any extent. They comprise a longitudinal study used by the company as *post hoc* verification of issues and credibility. All parties participate in the survey design.

Integration with the Biophysical: In the EIA, biophysical, and socio-economic assessments were separate components. The company has tended not to connect these areas, and within the company they are the separate concerns of two different groups.

Residents do not break issues neatly into biophysical, social or economic categories; they raise and respond to issues as they become important. Having limited time and energy, they focused first on the issues of highest priority: the integrity of the community and the acquisition of land by the company. Consequently, as land and hamlet relocation issues have been attended to, biophysical issues have assumed more prominence. The community is now becoming involved with reclamation, coal dust, or the effect of mining on water wells. Their approach to monitoring, that of participant observation, means that individuals are integrating the social and biophysical as they observe, document, and work to implement mitigative measures for any impact.

Collection and Analysis, Interpretation, and Feedback

Because of the process-oriented approach used, collection, analysis, interpretation and feedback are described in the following section, "Process of Analysis." In summary, this approach is able to capture and deal with a complex situation in a seemingly simple fashion, using very sophisticated soft technology, i.e., well-managed group process. This embodies the principles of social utility, through the manner in which issues are raised and dealt with; and social equity through its organizational arrangement, and more importantly, its commitment to shared decision making.

MANAGING THE PROCESS

Process of Analysis

The process of analysis is based on participation and shared decision making, using an extensive, highly interwoven communication network. The process assumes that "each participant has his own perspective . . . of the situation. And responses are not made directly to the actions of the other but instead to the meaning which is attached to such actions. In this way each participant interprets the actions of the other from their perspective" (Prokop 1983:5). In other words, it is a symbolic interactionist approach.

Residents bring issues to the attention of the designated parties. Individuals discuss issues with a COKE member (who may also be on the Steering Committee), or with a Steering Committee member (who may not be a member of COKE), and the issue is communicated to the Steering Committee, unless COKE decides to act on it. Individuals may also raise issues with the company representatives in the field.

It is a time-consuming process involving "observation, analysis, consultation, persuasion, bargaining, trade-offs, negotiation and mediation" (Prokop 1983:5). Conflict and its resolution are an important and valued part of this process.

Significance of change is determined mainly by the issues that arise and the degree to which they have been and can be satisfactorily resolved through a process of shared decision making. This is consistent with an impact management orientation.

The Keephills Surveys are the only formal measure of change, providing a relative measure of change for certain factors. The company has not compared the EIA with the actual outcome of events, either in the socio-economic or biophysical sectors. This is not important from a process perspective. Change can be observed in the hamlet relocation, but other changes are less obvious. The significance of change in the community has been examined in the surveys, and in the research of DiSanto *et al.* (1981), Frideres *et al.* (1984, 1985), Goldenberg *et al.* (1980, 1985), and Johannesson (1982).

Organizational Arrangement

The relationships between the various parties is shown in Figure A-1, although the figure does not adequately portray the extensive communication network that exists. In fact, the network is quite organic. The two main parties-at-interest have been TransAlta and the community (through COKE and the Steering Committee). COKE has been the action-oriented community group.

Process Management Issues

The previous passages describe an intensely process-oriented approach. Here we examine three process management issues: inclusion, receptivity, and commitment.

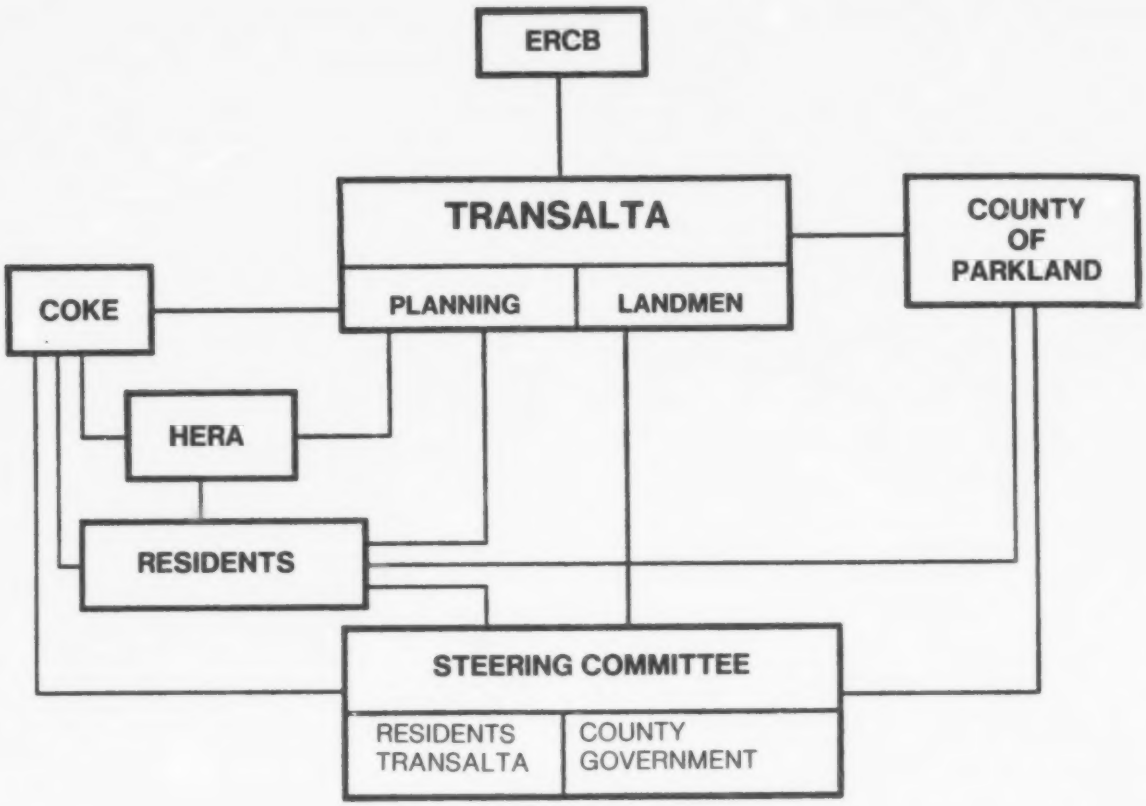

Figure A-1. Keephills Organizational Relationships

INCLUSION OF THE PARTIES-AT-INTEREST

Several parties-at-interest are involved:

- TransAlta,
- the Committee on Keephills Environment (COKE),
- the Keephills Power Project Steering Committee,
- consultants,
- the Government of Alberta,
- the County of Parkland,
- the Keephills Athletic Association, and
- neighbouring communities.

TransAlta is one of the two major parties-at-interest. Senior management developed an unprecedented policy for Keephills. The Generation Planning Department was responsible for establishing contact with the community, setting up the public participation program, sitting on the Steering Committee (which it was required to do by the Order-in-Council), and handling the hamlet relocation. The Land Department, represented by landmen, was responsible for direct contact with individual residents regarding the purchase of their properties, or for leasing company land to them; it also handled land acquisition related to the new hamlet. Project management was involved in the construction, and Public Affairs provided print material.

The Committee on Keephills Environment (COKE), the other major party-at-interest, was formed to represent the community. Only community residents are members of COKE. It has a paid membership, and a slate of officers, and has been responsible for preparing briefs for ERCB hearings, developing position papers, and negotiating with the company. Residents experienced major difficulty at the outset in organizing the group because of lack of experience and models to follow. Indeed, at the outset, many residents did not believe they could mobilize and confront the company.

COKE worked with the company to develop a land acquisition and a land leasing policy; the acquisition policy took three

years to negotiate, while the leasing policy took one year. COKE is still functional nine years after its formation, and its nine-member board continues to hold monthly meetings. The community worked together in developing the new hamlet. Factions have tended to develop around specific issues, but information is not available on these changing relationships.

From the community's perspective, the Keephills Power Project Steering Committee played a role subsidiary to that of COKE. It was, nevertheless, the formal mechanism that brought the community, county and company together. It exists under the auspices of The Land Conservation and Reclamation Council (the legal vehicle under the Land Conservation and Reclamation Act to handle matters related to surface disturbance). The Steering Committee consists of three members from the community (appointed by COKE, but not necessarily members of COKE), two representatives from the company, two from the County; three Government of Alberta departments (Agriculture, Environment, and Utilities and Telephones) have observer and advisor status. The Steering Committee has functioned mainly as a forum where community and company concerns are raised and discussed. It has held regular meetings since 1978, and the main participants continue to be represented. The Steering Committee has chosen not to become involved in land issues concerning individuals, but actively developed the approach to hamlet relocation in association with COKE. Meetings are private.

HERA Consulting Ltd. was hired by the company in 1976 to work for both the company and community. HERA originally suggested the idea of a Steering Committee to represent the community, county and company, and the company promoted the idea. It has also conducted the longitudinal surveys in 1978, 1981 and 1984. HERA acted in four ways: occasionally as mediators between the company and the community; in the development of negotiating positions for both sides; participating for the company in ERCB hearings; and meeting informally with members of the community (Frideres *et al.* 1985). Although paid by the company, HERA also provided considerable help to the community. The consultants have been instrumental in guiding the participation process during the nine years since project inception. The long-term involvement of HERA, whose principals are academics, is unusual. As academics, the consultants have maintained a high level of scientific interest in the project, writing several papers on the subject.

Three other consulting firms were involved: Makale and Kyllo Associates (hamlet planning); Saskmont Engineering (aspects of the new subdivision); and Rockliff Partnership Architects (new school and community hall). All planned their assignment with extensive community consultation.

Various departments or agencies of the Government of Alberta have been involved with the project. The ERCB conducted the public hearings and recommended that the project proceed. Alberta Agriculture, Environment, and Utilities and Telephones are represented on the Steering Committee. The chairman of the Steering Committee reports to the chairman of the Land Conservation and Reclamation Council. At various times representives of different departments have attended COKE meetings or met informally with community residents to discuss project-related issues.

The County of Parkland has played a low-key role on the Steering Committee but has been extensively involved with the company, negotiating for a new school, setting the tax base for the power plant, approving subdivision plans for the new hamlet, and attending to normal county matters, such as roads. These negotiations involved Council, the Planning Department, the Engineering Department, and the Board of Education.

Keephills Athletic Association was in existence before the power project was considered. The Association was the first group approached by the company. The Association, being the owner of the community hall, was involved in negotiations concerning the new hall.

Six neighbouring communities were involved in The Keephills School Advisory Committee, organized by the County to deal with discussions on the new school. HERA regrets not involving the community adjacent to the new hamlet more extensively.

RECEPTIVITY

Receptivity was not always easy to establish and maintain. One example that tested the patience of the company and one consulting firm was attendance at a lengthy evening meeting where discussion was limited to the kind of folding door to be used in the new community hall. At the end of the evening, no agreement had been reached. However, community-based planning and the need for the community to resolve issues in its own time frame were principles strongly adhered to in the long run.

COMMITMENT

The company committed itself to process monitoring and shared decision making through its statements in the EIA, senior-level policy statements, at public meetings and at ERCB hearings. It is formally committed by the Order-in-Council to participate on the Steering Committee, which through its terms of reference performs a monitoring function.

One indicator of its commitment is the funding it allocates to the process. The overall cost of the community program (hamlet relocation, surveys, half of COKE's expenses and all of the Steering Committee expenses, etc.) has been estimated at about $8 million, with the cost of relocation being about half of that amount. Operational expenses for COKE are met through a contribution from TransAlta and membership dues.

The community has had a high level of commitment to participation and monitoring throughout the project's lifetime. Residents have been active members of COKE and the Steering Committee, and were actively involved in hamlet relocation. Residents have not received remuneration for their involvement, except to recover expenses. The involvement of COKE in the hearings led the ERCB to develop a policy on intervenor funding, which it now applies to groups participating in any hearings.

Other parties have had varying degrees of commitment. HERA has been committed through its contracts with the company;

the academic interests of the consultants have undoubtedly maintained their continued interest and involvement. Government commitment is manifest largely through attendance at Steering Committee meetings. The county's major commitment has been in ensuring the provision of infrastructure through negotiations with the company. Neighbouring communities have not been extensively involved, except in terms of the new school.

ACHIEVEMENT OF OBJECTIVES

Objectives

The objectives discussed in this case have been constructed specifically for this analysis. They are based on our interpretation of what the various parties were attempting to achieve; the parties themselves did not set out specific objectives and then attempt to meet them. The reader should bear in mind that our interviewees were not thinking in terms of objectives, but when we mentioned them, they agreed that our statements sounded reasonable (or suggested changes). Thus, the objectives, although reconstructed, provide a means to evaluate the process that developed in Keephills.

Because objectives were not stated, and monitoring was only one activity in which the parties were involved, we have taken statements from various documents and related them to objectives identified in the framework. These objectives are related as closely as possible to the monitoring activities that developed in the Keephills project. We found that TransAlta, COKE, and the Steering Committee were involved in monitoring activities.

TransAlta's EIA submission in November 1976 identified its approach to public involvement (Calgary Power Ltd. 1976). In terms of SIA, the company indicated that it would:

- develop a sociological program, as a mitigative measure, to minimize stress to persons displaced by construction (the program would be designed after a detailed evaluation of the region and residents' attitudes were determined);
- conduct ongoing sociological studies to develop a data base;
- examine impacts on the native community;
- conduct a longitudinal study to assess impacts: "This will ensure intended objectives are reached, and in the event they are not, that an evaluation is built into the system" (Calgary Power Ltd. 1976: 6-15); and
- "...fully involve local residents in long-term planning of the Environmental Protection Program and a review of the ongoing studies of the Environmental Impact Assessment" (Calgary Power Ltd. 1976:6-17).

When interviewed, neither the consultants who prepared the SIA nor the company representative identified these statements as their objectives, other than the commitment to community involvement. The consultants said that the times were so uncertain that it would have been impossible to determine the key areas of focus in advance. However, they prepared an SIA recognizing the need to satisfy the regulatory agencies.

COKE is an incorporated society and as such has a charter containing its objectives or terms of reference. Its main purpose is to represent the community in dealings with the company. (We asked COKE to provide us with a copy of its charter, but we have not received it.)

General information on the Keephills Power Project Steering Committee (the Steering Committee) is based mainly on two reports (Boothroyd and Shires 1982; Boothroyd 1984). The Steering Committee was officially created in December 1977, by Alberta Government Order-in-Council #1380/77, which stated:

> *The Operator [Calgary Power Ltd.] shall satisfy the Land Conservation and Reclamation Council with the start of construction of the power plant or development of the extended mine site, of:*
>
> *(a) the establishment of a Keephills community Steering Committee with representation from the appropriate departments of government; and*
>
> *(b) the consultation with the Steering Committee on such matters as the relocation of the community of Keephills,* the monitoring of the project activities, *the review of environmental studies and final use of reclaimed land* [emphasis ours].

Terms of reference, drawn up by the Steering Committee, included these points:

- *[The Steering Committee will] provide formal communications about project activities primarily with the community, the County of Parkland and Calgary Power Ltd.*
- *The socio-economic impact of the development must be monitored to ensure minimum social disruption and maximum regional benefits.*
- *The Steering Committee will provide this monitoring function and will address problems with a view to developing solutions that are acceptable to all three organizations.* That monitoring function can be accommodated through Steering Committee meetings.

> *The Steering Committee will monitor project activities such as environmental studies, relocation of the Hamlet of Keephills, recreational aspects of the cooling ponds, future Keephills plant expansions, post-mining land use determination, and such other matters that may from time to time arise* [emphasis ours].

Additionally, the County of Parkland and the company have a legal agreement regarding corporate responsibility for payment to provide infrastructure, such as roads and hamlet facilities.

MONITORING OBJECTIVES

Objectives for monitoring are not clearly specified in the statements outlined above. The interviewees for both the company and HERA indicated that objectives were never considered, either by the company in interacting with the community, or in doing the Keephills Surveys, which were the only formal monitoring activities (the surveys were never referred to as monitoring, but were considered to be a longitudinal study). The following objectives are our interpretation of what monitoring objectives might have been, had they been specified and categorized as in our framework. The objectives are arranged in two groups:

- company objectives, consisting of:

  —project control: to ensure that the project is not delayed by community opposition and delayed land acquisition (Goldenberg *et al.* (1985) note the company was aware that refusal to relocate the hamlet could create a unified opposition capable of stalling the whole project),

  —impact management: to minimize stress associated with displacement and the presence of the project; and to maximize regional benefits,

  —corporate credibility (with the community): to maintain and enhance corporate credibility in the community (Goldenberg *et al.* (1985) suggest the prospect of relocating the community was exciting and challenging, and could contribute to positive public relations and a positive corporate reputation, and make it easier to deal with other communities in the future),

  —corporate credibility (with the Government of Alberta): to demonstrate adherence to the requirements developed in the Coal Policy, impact assessment guidelines, and terms of government approval. (DiSanto suggested that the company's approach was in direct response to the new government regulations and guidelines; these changes themselves were a result of the environmental movement in the previous years. DiSanto also suggests that enhancing corporate credibility is one way of demonstrating adherence to government policy, through community involvement and gaining the acceptance of the community.)

- a community objective

  —impact management: to ensure the community and residents get as fair treatment as is possible and to minimize disruption of hamlet relocation. (Interviewees generally stated that the legislation governing land acquisition by the proponent favours the proponent, so we included the phrase "as is possible" in the objective.)

Evaluating the Objectives

It is possible to determine the extent to which these inferred objectives have been met, provided certain data are available. The company has conducted a longitudinal study over a six-year period (the Keephills Surveys) and this provides certain social data. Information concerning the objectives of COKE and the Steering Committee is more difficult to identify, as their monitoring role does not involve data collection, such as an actual study; rather, the community observes, notes the changing circumstances, and works to achieve new acceptable conditions.

Potential indicators that could allow each objective to be evaluated are suggested below.

- company objectives

  —project control: number of incidents of delay, community opposition, comparison with other projects;

  —impact management:

  a) stress: pre- and post-stress measures, such as alienation, involvement, sense of control, community cohesion, medical and psychological problems; comparison with a control group;

  b) regional benefits: jobs, income, facilities, comparing before and after the project;

  —credibility (with the community): pre- and post-measures of level of opposition, reaction to company, company accessibility and response to issues; comparision with another community;

  —credibility (with the Government of Alberta): government intervention in the company's approach to community involvement; restrictions placed on the power plant project.

- community objective

  —impact management: participation in decision making, satisfaction with company's actions, perceived benefits and costs of project to community, individuals; comparison with other communities.

We will examine the data and general information that we believe relate to the objectives identified under project control, impact management, and credibility. These objectives, as noted above, are constructions based on the framework we have developed. The objectives have been discussed with project participants, and have been accepted as representing fairly the general intent of both company and community.

Note also that the company has not referred to the SIA since the public hearings in 1977. Thus, that document, and the specific intents mentioned in it, have not been used as a guide to company actions in all cases, although most steps actually taken by the company were proposed in the SIA.

Other than for the Keephills Surveys, traditional scientific monitoring was not part of the project. Thus, we do not always have monitoring data to use as a measure in the achievement of objectives. When monitoring data is not available, other relevant information about the project is used to provide the evaluation.

COMPANY OBJECTIVE: PROJECT CONTROL

The project was not delayed as a result of community intervention. Certain issues regarding the project were brought to the company's attention through COKE and the Steering Committee and relayed to the construction group. Some changes in the original plans for the project may have occurred as a result of community concerns, but these did not cause a delay in construction.

The power plant was commissioned on schedule in 1983. The delay in project expansion was due to the change in the economy, and not to any community opposition.

We consider that the company's objective of project control was met.

COMPANY OBJECTIVE: IMPACT MANAGEMENT

The degree to which the objective of impact management to minimize stress has been met is difficult to determine. Objective indicators are not available, and the company did not originally state what would constitute a minimal stress level. Indeed, since stress is a result of experiencing change, the introduction of the project and the hamlet relocation can be considered highly stressful, even though hamlet relocation was a positive community goal.

Relevant information that could help in evaluating this objective is not available. The company has not stated that it has a sociological program to minimize stress, as proposed in the SIA. (We infer that the processes developed during the project, such as public participation, were meant to do this.) A control group was not compared to the Keephills community. Baseline data on the community before the project does not exist to compare with subsequent analyses. Thus our analysis is based on subjective indicators from the surveys (1984 data is reported except where noted), the research papers, and general indications from the interviews.

Results from the three Keephills Surveys show that the general feeling about the community has improved, now that the major disruption has passed. Fifty-nine percent of the residents state they experienced change.

In terms of community cohesion, about 50% of the residents believe the community was brought closer together by the project, while about 30% thought the project had split the community. One resident we interviewed suggested that if the company had moved sooner to ensure the hamlet would be relocated, some of the residents who moved away might have remained in the community. Another indication of steps taken to maintain community cohesion is the relocation of the hamlet, which involved all parties, and the company's commitment, as shown by funding. The large turnout of residents when the new hamlet opened shows the importance of the hamlet to residents. After nine years, COKE remains the main organizing vehicle for the community.

Even today, land acquisition continues to be an issue. The company has yet to purchase land south of the main highway that passes through the community. Two of the five community residents we interviewed (they were chairmen of the two committees) believe that sale prices did not often reflect the true cost to the family who had to move. Although the price may have been a fair market value, it did not cover moving costs, lifestyle disruption and, in several cases, the acquisition of an equivalent property. We have no data to indicate what stressful conditions may have been imposed as a result of these situations.

In general, Frideres *et al.* (1985) found a consistent decrease in alienation over the surveys. They considered this to be largely related to an effective public participation program. However, land negotiation and alienation were positively correlated: those who had to negotiate land deals with the company had higher alienation scores. This evidence is supported by the work of Johannessen (1982) in his study of six families who had to sell to TransAlta. The compensation for land did not cover replacement costs for their new location; people could not always get an equivalent location; they suffered a loss of income; and there were certain increased costs with the new location (such as taxes). They also reported psychological and mental problems: anxiety, stress associated with negotiations, emotional and mental energies diverted to land negotiations, and conflict with neighbours or other community members. These individual situations are masked somewhat in the surveys: in the 1981 survey, 60-99% of the respondents (depending on the indicator) reported they had no increase in stress or health-related problems from 1978 to 1981. However, exactly who and how many were involved in land negotiations is unknown.

Little monitoring data on the company's objective to maximize regional benefits are available. The 1984 survey (of 66 families) found that slightly over 25% of the households had someone who worked at the power plant or in the mine.

Other general information suggests there have been regional benefits. New residents have moved into the area because of the project. The company spent over $4 million to relocate the hamlet, and build a new school and community centre. There is no information on other economic benefits, nor any indication of the effect on farm production.

The company made several approaches to the local Indian band to establish contact and ensure that it was involved in the project. The band has not responded in any participatory way. Benefits to the band are not known.

Residents we interviewed stated that the community has benefitted from employment, the new hamlet and related improvements; and that it has been affected by the general disruption created by the project. The long-term interaction has exacted an opportunity cost because people have taken time from pursuing other interests or responsibilities to devote themselves to project-related issues.

We conclude that this objective was met to a considerable extent at the community level. (This is a subjective judgment, based on our knowledge of other situations.) The major deficiency relates to land negotiations with individuals; from the individual's perspective, it remains an inequitable process. Some issues also remain unresolved.

COMPANY OBJECTIVE: CORPORATE CREDIBILITY

The company has generally been viewed favourably in its approach to the community. In the 1984 survey of 66 families, 83% reported that communication has been sufficient; that the company has dealt fairly with people in regard to community participation (84%), hamlet relocation (91%), and the information program (75%); and that it has been fair to people moving into the hamlet (97%). In the 1981 survey of 96 families, 56% rated public participation good to very good, 36% fair; in 1984, 68% indicated good to very good, and 21% fair.

Other indications of corporate credibility are continued participation of the community in the Steering Committee, and community involvement in survey design.

We consider that corporate credibility was maintained, if not enhanced, given the high positive percentages associated with the survey questions; and there appears to have been an improvement in the company's image over the years.

There is no indication of further government intervention in the dealings the company has had with the community. We consider that objective of corporate credibility with the Government of Alberta was met.

COMMUNITY OBJECTIVE

The following indicators relate to the community's perception of its role in impact management (numerical data is from the 1984 survey).

- Respondents considered the public participation program beneficial. Nearly 90% believed the public participation program educated the community; 70% believed that it allowed for participation in actual decision making; about 25% believed it had "conned" the community.

- COKE is considered by residents to be the principal community representative, and to have an influence in issues that relate to the power project. Nearly 95% of the respondents believe the community, through COKE, had an influence on decisions regarding hamlet relocation. COKE is considered to be effective, representative, and accessible to the community. Fifty percent of those surveyed had been members at one time or another, as have 40% of their spouses.

- Residents believe the community has had an influence on the following decisions related to the project: hamlet relocation, 94%; land compensation, 68%; environment, 57%; and mining, 54%. Eighty percent of respondents believe the Keephills model is good for other developments.

- Other general indicators relate to the sense of community spirit and achievement. Boothroyd and Shires (1982) reported that the Steering Committee (together with COKE) had a sense of pride in planning the new hamlet and developing conditions for the relocation. Although the plant is now fully operational, residents believe that a public participation program (58% yes), a monitoring program (77% yes), COKE (85% yes), and the Steering Committee (47% yes) are still needed.

- Residents we interviewed stated satisfaction with the involvement process ("as good as can be expected given the reality of the situation") and would recommend such a process for other communities, with modification. This does not mean, however, that they really wanted the power station in their backyard. They do feel that current government legislation sets the scene for an inherently inequitable process, particularly concerning land issues, and that the community should have more power, more support from government and more access to expertise. They also want the knowledge of their experience to be available to other communities affected by development.

The community appears to have met its (inferred) objective of minimizing disruption and maximizing benefits through its involvement in decision making concerning the project.

The major benefit stated by those we interviewed has been the educational and learning experience of dealing with organizations and community interactions. As a result, Keephills has become more aware of how best to represent its own interest and will not willing be passive in the face of development.

CASE 2: THE ATIKOKAN POWER PROJECT

BACKGROUND

Ontario Hydro, a major electrical utility, began studies in the early 1970s to determine how it would meet future electricity needs of northwestern Ontario. As a result of these studies, Hydro proposed to build an 800 megawatt (four 200 megawatt units) lignite coal-fired generating station in the Township of Atikokan. Specifically it proposed initially to build two 200 megawatt units, to be completed by April 1984. Construction would take five years, with the workforce peaking at 950 workers in 1982. The permanent operational staff was projected to be 200 workers. Other units would be added later.

Atikokan is a community of 4,700 in northwestern Ontario, about 200 kilometres from the nearest urban centre, Thunder Bay. At the time of the proposal, it was a single-industry community based on iron mining.

History of the Project

In 1975 the Ontario Government gave its approval to Ontario Hydro to purchase a site at Atikokan for construction of a power station. By January 1976, the SIA Statement, *Marmion Lake Generating Station Community Impact Study: Phase 1 Report* (1976) was completed. It projected that Atikokan would "boom" as a result of construction and then "bust."

In July 1977 the Government gave Hydro approval to proceed with the project. Construction began in January 1978.

Also in January 1978, consistent with corporate philosophy, Hydro signed a legal agreement with the Township of Atikokan to compensate for impacts related to the project. This agreement would be in force until October 31, 1985 or the first anniversary of the in-service date of the second generating unit. Supplementary agreements were signed in 1978 for road impact monitoring, community impact monitoring, and the Saturn Avenue extension.

The recessionary economy of 1979 had several impacts on the area. Steep Rock Iron Mines and Caland Mines announced layoffs of 1,000 workers. An estimated 3,000 Atikokan residents were associated with those jobs, so mass out-migration was predicted. Moreover, Hydro conducted a review of its power needs that resulted in a one-year delay on in-service of the first generating unit (to 1984 instead of 1983).

In 1980, the remaining 130 workers were laid off from the mines. The monitoring report for that year stated no strains on the service capacity of the township. Workforce size decreased; part-time and service jobs increased. School enrolment decreased; and little new home construction occurred. The actual population decline was 459, compared to the estimated 3,000.

The next two years marked uncertainty about whether to proceed with construction of the generating units. The second unit was cancelled in February 1982. In 1983, Hydro decided to complete and commission the first unit and to put it into operation in November.

A supplementary agreement for sewage improvement was signed in 1982.

Strikes in 1984 and 1985, as well as technical problems, delayed the in-service date to November 14, 1985. While a "boom-bust" cycle had been predicted, actual impact was minimal according to the monitoring program results, because of unanticipated events.

MANAGEMENT CONTEXT

Complexity and Uncertainty

The Atikokan power station was proposed in response to the energy crisis. However, the project was originally expected to proceed in relatively certain circumstances: a "boom-bust" cycle. The community was isolated and all parties were committed to continued support of monitoring (by signed legal Agreement); hence, the assumed ease of impact verification.

Several factors intervened throughout the monitoring:

- Turnover in the position of the community studies planner occurred due to other assignments and priorities, and promotions.

- Economic change occurred at the national and international level: The general growth economy, heavily dependent on energy development, went into decline; the layoffs in the mines were unexpected and had not been considered at the beginning of the agreement; (the combination of the decline in the Alberta tar sands and the mines layoffs closed the opportunity for out-migration of laid-off mine workers from Atikokan to Alberta); in response to the changing energy forecasts, the station was downsized to one 200 megawatt unit.

- Union strikes led to delays in the in-service date, creating anxiety in the Township over delayed payment of grants-in-lieu of taxes (which depend on station operation); as well, the unions negotiated specific clauses in their contracts which served as intervening variables for SIA impact. For example, the travel allowance in the contract resulted in workers hiring buses so they could commute to Thunder Bay rather than living in Atikokan; whereas the SIA Statement had assumed that the 200 kilometre distance from Thunder Bay would result in workers living at the camp in Atikokan (Hardy 1982).

- One factor that was anticipated, and thus specified in the Agreement, was that potential implications of negotiations with the United States on emission levels of sulphur dioxide (related to acid rain) could change the economic viability of the station. This did not happen.

THE MONITORING APPROACH

Scope

The Agreement specified the scope of the monitoring program. The major factors considered were: population, employment and incomes, housing, education, social conditions, municipal services and facilities, and roads and municipal finance (see Table A-2). The boundary was defined in the Agreement as "the Township or the Planning Area of the Township whichever is greater" (Ontario Hydro *et al.* 1978c: 2).

Integration with the Biophysical: According to the Agreement, all documents regarding environmental impact were to be supplied to the Township. The community monitoring program was not structured to include biophysical issues. Recently concerns have arisen about air quality, and the potential effects of air pollution on Quetico Park.

Collection and Analysis

Ontario Hydro commissioned a conceptual framework for a monitoring and review system (Proctor and Redfern 1979). The suggested approach for impact management was the Rolling Target orientation. The monitoring baseline began with an SIA Statement, specifying the forecasts and assumptions. In practice, forecasts were not revised largely because the minimal nature of the impacts measured did not seem to warrant it.

Statistics were collated monthly and an annual report filed as a public document. Data collection was based on official records kept by agencies and collected by the co-ordinator. The co-ordinator was viewed by Hydro as essential in obtaining continued access to these data, because he knew and was respected by the community. Hydro supplied project records of commuters, those living in the camp, and the number of employees, on a monthly basis.

Problems with data occurred. These included:

- difficulties with access, since some agencies were not used to record keeping: Government data tended to be useful but late (according to some interviewees); local agencies experienced some difficulties in providing data because of other, higher priorities; lack of direct benefit was a disincentive which the co-ordinator counteracted by providing "thank you" luncheons;
- inconsistencies in population data between Statistics Canada and the Ontario assessment rolls: A separate census could have been undertaken at considerable expense but it would likely have yielded numbers which differed from the other two data bases and would have been of limited utility;
- concern over who should collect primary data: e.g., the Township wanted local people to do the traffic counts for road monitoring, rather than an independent expert. In the end the co-ordinator looked after hiring local people and sent the data to the Ministry of Transport for analysis.

Interpretation

Ontario Hydro expected the measurement and attribution of change to be relatively easy because of the nature of Atikokan, which was assumed to have no commuter shed (and likely didn't until the Hydro union contract made provision for commuter allowances), only one major employer (the mines), and a strictly defined trading area.

Attributing the sources of change became difficult when Ontario Hydro recognized that it had underestimated the role of extra-local linkages in the economy. Changes in world oil prices, interest rates and the value of the Canadian dollar all influenced what happened in Atikokan. The national and international economic situation resulted in the mines' layoffs, thus violating the assumption that the mines were the major employer in Atikokan and that Hydro would diversify the local economy.

Assessment of the significance of change was difficult because the presence and interrelationship of intervening variables was unknown. For example, a housing shortage was originally predicted due to the influx of Hydro employees, especially during the construction phase. In response, Hydro built a camp, assuming that workers without families would prefer to live there, rather than living in Atikokan and commuting 400 kilometres daily. Employees with families, and those with permanent jobs, were assumed to prefer living in the Township rather than commuting because of the long distance involved; to prefer buying homes rather than renting; and to prefer higher priced homes because they could afford them.

Each assumption was mistaken. Of workers without families, many preferred to live in the Atikokan rather than in the camp. Workers pooled their housing allowances so they could rent homes and, in response to the need, some residents turned their homes into boarding houses. About 100 workers pooled their commuting allowances and hired buses to take them the 400 kilometres each day to Thunder Bay. Workers with families rented rather than bought homes. They could not afford the kinds of downpayments and guarantees required to satisfy the bank, since Central Mortgage and Housing Corporation would not guarantee mortgages in what was viewed as a single-industry township. Under such circumstances, workers were not interested in buying higher priced homes. All these factors resulted in a shortage of rental housing.

With the mines' layoffs of 1,000 workers, a housing surplus was predicted on the assumption that these workers and their families would move elsewhere in search of work. The most likely source of employment was the Alberta oil sands but those projects were soon cancelled. Up to 3,000 people could have left Atikokan (based on a 3:1 multiplier); 459 did. The availability of their homes eased the housing shortage. However, many miners stayed in Atikokan. They found jobs

Table A-2
Variables Monitored at Atikokan

Data Item	Information Requirements
Population	total numbers by municipality • age-sex distribution • urban-rural distribution • family/non-family households
Employment	jobs per sector • basic/non-basic employment • union membership • wage rates
Housing	housing stock by type • temporary accommodations • tenure and cost of units • factors influencing supply • planned housing areas
Education	number and locations of schools • enrollment, teaching staff, school capacities • pupil/teacher ratio
Health Care	Atikokan General Hospital • number of beds by type • current bed and outpatient use • emergency services • physicians by specialty • hospital manpower • other: Atikokan Clinic • ambulance and service area • agency referrals
Safety Police	size of force • equipment (cars, etc.) • types of calls • types of crime (major, minor, juvenile)
Fire	size of force • equipment and pumping capacity • losses by fire, severity of fires • frequency of calls
Librairies	locations • number of volumes • contract agreement with regional library staff • number copies books lost or damaged
Recreation	park acreage • physical facilities • user demands on parks
Sewage and Water Treatment	plant location • type of treatment
Solid Waste	disposal and collection services • sanitary landfill sites: capacity, plans
Day Care	local and services offered • number of children involved
Administration	municipal staffing departments • building permits — value in dollars
Industrial	number of serviced industrial lots • new jobs by sector
Finance	tax base • municipal budget: operating, capital • debt service and limits • provincial and federal grants • ratio of residential, commerical and industrial assessment
Health and Welfare	homes for aged (Fort Frances) • family counselling • social services and assistance — administration and delivery, cost per capita, trends in costs
Land Use	review Official Plan, amendments • designations by acreage • existing uses by acreage • land and property values
Housing	rents by unit type • apartments • commercial and industrial • number of housing starts
Social Factors	
Alcoholism and Drug Abuse	overall consumption • per capita consumption
Unemployment	unemployment rates
Income	average personal income • disposable incomes
Justice	number and kinds of offences • number of court cases
Welfare	number of people receiving welfare assistance, family and children's services • child abuse cases reported • increase in police, social service, pastoral counselling
Cultural	community organizations • number of members

Adapted from Ontario Hydro *et al.* 1978c (Appendix A)

with Hydro, part-time jobs, and/or their wives found jobs, as ways of making ends meet without moving.

Therefore, even when changes were noted (for example, a housing shortage), the intervening variables influenced the situation. This made it even more difficult to take action since some problems seemed to take care of themselves. As one interviewee said, "We didn't see the things we were looking for, so we didn't know what to do." This is not an unusual circumstance in monitoring.

Ontario Hydro also encountered other difficulties related to its plan for compensation upon verification. Hydro had to be more lenient in its interpretation of what constituted proof for impacts associated with the B Account funds. These were for "soft services," such as legal fees, and were subjective and difficult to measure.

The only philosophical difficulty Hydro had with the limits of its responsibility as a change agent was in compensating the community for providing the services Hydro needed (Hardy 1982). For example, while drinking-water quantity was sufficient, the water quality was not up to the newcomer's standards. Should Hydro be responsible for paying for upgrading?

Feedback

There was ongoing consultation between various representatives of Ontario Hydro and the Township. Data were shared monthly. Annual reports are public documents.

MANAGING THE PROCESS

Process of Analysis

A legal agreement was designed as a vehicle for mutual protection: to protect the community from impact-associated costs, and to protect Ontario Hydro from paying for unsubstantiated costs. The Agreement was developed by the Township and Ontario Hydro.

The decision process is set out in the Agreement, and includes a mechanism for arbitration should disagreement arise. Arbitration has never been used. The co-ordinator gathered and collated data on a monthly basis in consultation and review with the community studies planner. (The co-ordinator visited Hydro's head office four to six times each year. Monitoring and associated personnel visited Atikokan about three times a year.) The co-ordinator then consulted with the Township Council, the planner consulted with the project manager. Informal pre-negotiations between the parties would then occur. Meetings between Council and Hydro followed.

The decision process centred largely around verification of impact in order to obtain compensation. Sometimes the Township identified a need; sometimes Hydro did; sometimes both did. At times Hydro offered assistance but it was declined; at times the Township requested compensation but the case was denied.

The Township presented some cases that Hydro did not believe it should pay for, such as a Zamboney to clean the ice rink. The Township reasoned that since the many Hydro employees used the rink, cleaning the ice was a station-related impact and Hydro ought to pay. Hydro's position was that their employees paid taxes to cover such costs.

In an attempt to be fair and to use the Agreement creatively, Ontario Hydro encouraged submission of certain types of evidence for consideration of impact payments. For example, Hydro was willing to pay for extra staffing requirements for the police. The police did not view this as necessary but were encouraged by Hydro to submit the data so that compensation could be received. It is not certain that these monies were then allocated to the police; they went into the Township's general revenue.

Negotiations remained largely informal until the Agreement was in its final phase. At that time, the station was not operational, due to strikes, so grants-in-lieu of taxes were not forthcoming. The Township was without a major source of funds during this critical period. It then pressured Hydro for the monies left over from the B Account, which were viewed as the Township's monies. (Unexpended B Account monies reverted to the Township when the Agreement ended.) Hydro did not want to release such funds without impact verification, until the time specified in the Agreement. Under these circumstances, according to some people interviewed, the co-ordinator responded by becoming more formal in his interactions. In general, both parties have remained on good terms.

Organizational Arrangement

The organizational structure set out in the Agreement consists of Ontario Hydro and the Township Council, along with its co-ordinator. The community studies planner is responsible to the construction and project managers, who budget for the Agreement. The structure is shown in Figure A-2 below. In practice, extensive use was also made of informal mechanisms.

Process Management Issues

INCLUSION OF THE PARTIES-AT-INTEREST

Three major parties-at-interest are two co-sponsors (Ontario Hydro and the Township Council) and the object of study (Atikokan).

Ontario Hydro, the proponent and monitoring co-sponsor, had several actors involved: senior management, the construction and project managers of the station, and community studies planners from its Social and Community Studies Section.

The Township of Atikokan, the other co-sponsor, is represented in the Agreement by the Township Council. Council is noted in Ontario for being self-reliant and positive; it is highly regarded by the provincial government for its expertise in obtaining grants. The Township Council was positive toward the monies referred to in the Agreement. Its style of negotiation is considerably less formal and "accountable" than that of Hydro and at least some members would have preferred a

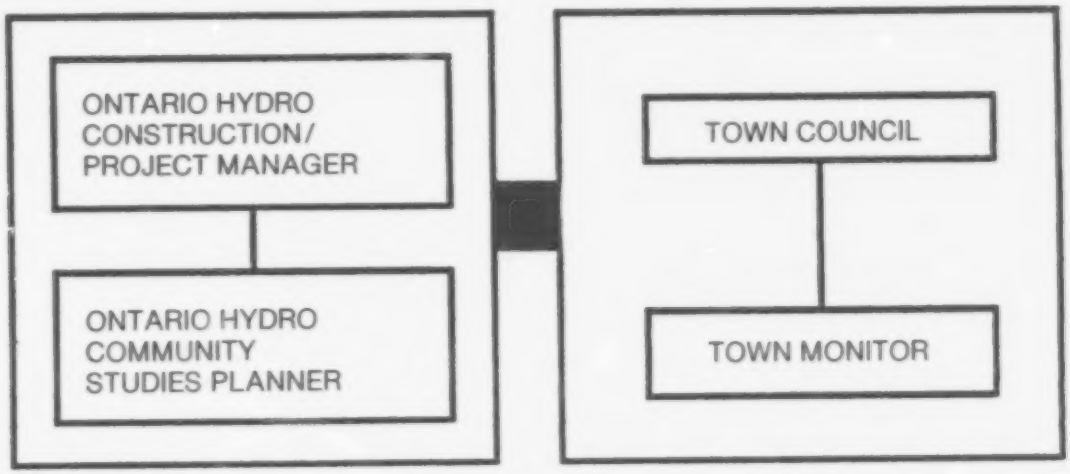

Figure A-2. Atikokan Organizational Relationships

looser understanding with more room for negotiation. They saw the Agreement as foreign and complex, but the only game that could be played. They have little interest or expertise in formal planning.

The Township selected a co-ordinator who knows the area well, is involved in local politics, and is well liked. Council relied largely on his judgment. His job was to gather data from various service agencies and to serve as liaison between Hydro and Council. Hydro initially expected that data analysis and interpretation would be performed by the co-ordinator, but instead Hydro staff assisted in data analysis and interpretation.

As well, the Township and Ontario Hydro relied on professionals in other organizations to provide data. No interest groups were mentioned at the onset of the Agreement.

RECEPTIVITY

In general, relations between Hydro and the Township have been cordial. Negotiating is intrinsic to the relationship and from time to time conflict has emerged. No instances of arbitration are recorded. The co-ordinator stated that the only major disagreements were with one or two groups within Hydro that had dealings with the Township but did not recognize themselves as being under the Agreement.

Both parties cite the importance of the Agreement in providing a common ground. The Township noted Hydro's change of style when it encountered difficulty in proving that impacts were caused by the company; Hydro became more flexible and "used more than statistics to settle arguments." And both parties cite the importance of allowing plenty of time for discussion before pressing for issue resolution.

Hydro attributes much of the Agreement's success to the presence of a compatible, respected local co-ordinator. The importance of mutually acceptable procedures, the compatibility of the philosophies and working styles of the major parties-at-interest, and their ability to be flexible and adaptable, are cited as key factors in successful impact management (Hardy 1982). Note that Hardy is comparing Hydro's success at Atikokan to Hydro's monitoring attempts elsewhere, so he is arguing from a multi-case base.) Others remarked that the Community Studies Planners were receptive to Township concerns.

However, Hydro and the Township held very different planning values. The Township is not planning-oriented in the professional sense, preferring a less formal, open-ended negotiating style. Single-industry towns like Atikokan are very vulnerable given fluctuations in the national and international economy, and the difficulties in diversifying a northern, isolated community. The Township may manage as well or better, with its negotiating, grant-getting approach than it would with formal planning. Under "boom-bust" conditions, increasing formalization of the planning function would likely be necessary and would present such a threat as to change the membership of Council, if experience elsewhere is any guide.

Hydro does believe that the municipality has the ultimate authority to control its destiny. The corporation, however, was constantly confronted with the need to intervene to supply expertise. In Atikokan, Hydro is "the big man in the Township." Under boom conditions, Hydro's concerns about paternalism would no doubt surface. This is a key issue that has yet to be resolved.

COMMITMENT

Senior management at Ontario Hydro supported the monitoring concept because of its positive public relations value and because Hydro needed an ongoing impact verification and arbitration mechanism. It had previously dealt with impact issues through Section 47 of the Power Corporation Act (see Hardy 1982). The problems associated with Section 47 came to light publicly during the hearings of the Royal Commission on Electrical Power Planning; the prime example used was the socio-economic impact associated with Hydro's Bruce Nuclear Power Plant. As a result, Hydro was very interested in using another mechanism for compensation. Hydro's policy is that "communities would not suffer as a result of the construction and operation of a generating station" (Walker 1979:3). Senior management was committed to impact management monitoring on the grounds of long-term cost-effectiveness. Impact management monitoring offered them the chance to be seen as a good and fair neighbour.

The construction and project managers both felt the plant must be a good corporate citizen. In fact, they encouraged staff at Atikokan to help with community activities. The project manager deliberately brought conferences to Atikokan, ensured that part of the construction camp would be donated to the Township, and gave surplus materials to the Township. The managers were supportive of mechanisms to maintain corporate credibility.

The Social and Community Studies Section has a planning orientation and is committed to SIA and long-term, responsive planning. Atikokan presented an opportunity to demonstrate that the section could provide a service to the line divisions in Hydro, as well as a chance to further the development of monitoring in SIA. (Senior management commitment to monitoring was seen as an important commitment to the section itself.) The section views impact management as a business, requiring accountability and professionalism. They looked on Atikokan as a social studies lab, feeling that its relatively isolated location would make an ideal testing ground for a monitoring program because impact verification would be relatively easy.

In summary, Ontario Hydro was committed to monitoring at Atikokan, and to the monitoring objectives, largely for credibility, since impact monies would have to be paid anyway.

The Agreement allocated $1,125,000 of Hydro's funds, plus indirect staff costs. With interest, this resulted in a total of $1,750,000. It was divided as follows:

- A Account — $435,000 for provision of hard services such as road and bridge improvements; unexpended funds revert to Hydro at the end of the Agreement;
- B Account — $400,000 for provision of soft services such as legal fees, monitoring costs, and development of an Official Plan; unexpended funds revert to the Township at the end of the Agreement, this being an incentive to encourage careful management of these monies;
- $285,000 in special grants for building permits, financing the costs of a new sewage treatment plant, etc. Additional monies could be made available when the Agreement terminated, if necessary.

The Township was supportive of Hydro's presence in the area and was committed to the concept of compensation. The Township contributed indirect staff costs, along with agreeing to forego other methods of dealing with Hydro. The co-ordinator is personally committed to monitoring on behalf of the Township.

Most other parties were not aware of the Agreement and thus were neither actively committed nor interested. However, the monitor stated that everyone in the community was supportive of Hydro's presence in the area and had worked hard to attract Hydro to the Atikokan site when others sites were being considered.

ACHIEVEMENT OF OBJECTIVES

Objectives

Three objectives are related to monitoring: impact management, credibility, and maximum compensation for the community.

The impact management objective specified the need for monitoring to verify impact, to provide compensation and remediation. Two references (Ontario Hydro *et al.* 1978a, c) indicate that:

> *The Corporation agrees to compensate the Township for those financial impacts which result from the construction and operation of the Station including financial impacts resulting from any reduction in population in the Township due to the completion of the construction of the Station and subsequent emigration of workers from the Township. . . . The Corporation agrees to propose methods, review proposals and to participate with the Township in a process of monitoring the ongoing social, economic and financial impact of the construction of the Station in the Township and to fund expenses incurred by the Township for such a monitoring program, including additional studies, if required. . . . The monitoring program referred to . . . shall continue in force for an additional period of one year from the effective date of termination in order that compensation due to the Township to the date of termination can be determined* (Ontario Hydro *et al.* 1978a).

> *Corporation and the Township agree that the Community Impact Monitoring Program will include: (a) data collection and updating of items shown in Appendix 'A' to this Agreement; (b) identification of community impacts and recommended mitigating measures in association with responsible government ministries; (c) an annual report on community impact in the form of an audit . . . . The Corporation agrees to pay compensation for those impacts which require remedial actions. Separate Supplementary Agreements and/or memoranda of understanding between the Corporation and the Township will be entered into.* All claims for impact

> covered under this Agreement, shall be accompanied by support documentation that will include the following: (a) data base inventory and the pre-construction conditions as established in 1978; (b) all relevant and recent data on the particular item included in Appendix A; (c) an analysis of changes occurring to the Township on each data item (Ontario Hydro *et al.* 1978 c, emphasis ours).

Hydro wanted to maintain corporate credibility in Atikokan in two ways. First, it wanted to ensure that the construction of the station would not be opposed. In return for the Agreement, the Township agreed to forego other methods of dealing with Ontario Hydro, including opposing or delaying construction and operation through the permits and licensing process. Second, Hydro wanted the Agreement be seen as fair, to accept responsibility for impacts without having to honour frivolous requests for community relations monies; hence the requirement for impact verification.

The objective of maximum compensation for the community ensures that the Township receives what, in its estimation, is owed to it by Ontario Hydro.

Although this objective was never stated explicitly, we believe it can be inferred as an objective of the Township.

Evaluating the Objectives

All objectives can be evaluated.

Regarding impact management, the Agreement outlines what constitutes success in terms of the impact verification (quoted above): baseline and ongoing data with analysis by item.

The credibility objective is specified in the Agreement, regarding agreement not to oppose the station. Obviously evidence of opposition, impeding the licensing and permitting process or reports that "Hydro was or was not keeping its part of the bargain" would be indicators of the degree to which this objective was achieved.

Maximum compensation for the community: Evidence for achievement would consist of the Township receiving all monies stated in the Agreement, plus others that could be justified.

IMPACT MANAGEMENT

It is difficult to completely discern Hydro's role or the role of the Agreement in mitigating impact, since so many intervening variables were involved. Originally a "boom-bust cycle" was expected but did not occur. At the peak of station construction, Hydro was able to hire many locals due to the mines' layoffs. Compared to what had been expected, the station-related impacts were minimal and were handled by the Agreement process. In this sense the Agreement worked and impacts were managed.

Monitoring data were not always used as the basis for compensation. In many cases it was not possible to do so.

It is hard to say if the Agreement and monitoring would work as well under "boom-bust" conditions. The Agreement was based on professional, responsive planning principles. It assumed that the model of good community development it brought to the Township would be mutually acceptable, and the community studies planners assumed the model would be adopted. We can say that Hydro did compensate on proof of impact, and that the requirements of proof varied depending upon the A and B Accounts. However, Hydro was so concerned with proof of impact, and fearful of payment on whim, that it set up a system in which quantitative, empirical data were most highly valued. Circumstances were such, however, that other information was sometimes needed.

Hydro's concern with verification of impact and its technical approach to SIA resulted in the collection of empirical, quantitative data, although this was not required. Hardy (1982:11) suggests, in retrospect, that this was necessary, but insufficient to understand the situation being monitored:

> *[We] learned that the empirical and quantitative data must be linked with a detailed and continuing examination of the non-empirical, qualitative, and intangible elements of community changes. . . . agreements and monitoring appeared to be better designed to deal with physical impacts which could be quantified using empirical and quantitative data and less well-designed to deal with the non-quantitative data pertaining to psycho-social impacts. While both sets of data were important . . . the formal legal nature of this agreement militates somewhat against the effective management of psycho-social impacts.*

We consider that this objective was met, although not necessarily solely due to Hydro's intervention.

CREDIBILITY

Hydro's credibility seems to have been maintained in Atikokan. Special interest anti-Hydro groups, negative press or other such indicators of lack of support were not evident. The Township did not impede the permitting and licensing process. A trusted local resident playing the role of monitor and a project manager who believes in the importance of community relations were key factors in the maintenance of credibility. However, at times the community studies planners and the project manager had different views of the degree to which community relations should give way to the principle of compensation upon verification of impact. If the planners had been unable to insist upon verification, as per the Agreement, compensation without such rigorous verification might not have occurred, thereby reducing the need for monitoring. This is particularly critical under low impact conditions, where the need for monitoring, among people not associated with SIA, is less apparent.

We consider that this objective was met.

MAXIMUM COMPENSATION FOR THE COMMUNITY

This objective of maximum compensation for the community appeared clearly when the Agreement was in its final phase but has never been explicitly stated. The Township did receive

the compensation as outlined in the Agreement. This is documented in the annual reports. Unexpended B Account monies revert to the Township. It is difficult to estimate whether the Township received more or less monies that it would have without monitoring and the Agreement, that is, solely by using the principle of community relations.

The Township encountered difficulty in using the Agreement in ways it would have liked and left most negotiation to the co-ordinator. The Agreement was viewed as an excellent safeguard for a single-industry Township.

There are some indications that residents were disappointed that more jobs were not available for local people, because of the role unions played in hiring practices; and that they are unaware of the extent of compensation received and its actual impact in cushioning the local economic downturn.

We consider that this objective was met.

CASE 3: THE HUMAN SYSTEM RESEARCH OF THE ALBERTA OIL SANDS ENVIRONMENTAL RESEARCH PROGRAM

BACKGROUND

In the early 1970s the economy of Alberta began to boom as a result of the developing energy crisis in North America. This was manifest in the province by considerable increases in activity in coal mining, oil and gas production and exploration, in the oil sands near Fort McMurray, and in the heavy oil area near Cold Lake.

Oil sands technology was new and economically marginal. The Suncor oil sands plant near Fort McMurray had been operating since 1967. Construction of the Syncrude oil sands plant was completed in 1978 and required 7,000 workers at the height of construction. The Syncrude plant now employs over 4,000 in its operations and produces about 115,000 barrels per day of synthetic crude oil. Pilot plants were operating and planning was underway for additional large oil sands plants. As a result of this industrial activity, the population of Fort McMurray rapidly increased from 6,850 in 1971 to 25,000 in 1978, and the city has continued slower growth since then.

The Government of Alberta responded to this industrialization by developing new programs, such as the Alberta Oil Sands Environmental Research Program (AOSERP).

We will first outline the history of AOSERP, followed by a brief history of the human system committee. The analysis will then focus on the human system committee and its approach to research.

History of the Project

In June 1974, representatives of the Government of Canada (from Fisheries and Environment Canada), and representatives of the Government of Alberta (from Alberta Environment, and Alberta Energy and Natural Resources) met to discuss the potential for mutual co-operation in oil sands research. They recommended a jointly funded, 10-year, $40 million research program, beginning in April 1975.

Planning for the program involved five services in Fisheries and Environment Canada: Fisheries and Marine, Canadian Wildlife, Canadian Forestry, Environmental Protection, and Atmospheric Environment. The Government of Alberta was represented by Alberta Environment, Alberta Energy and Natural Resources (Forestry, and Fish and Wildlife), and the Alberta Research Council. Shortly after initial planning began, the Alberta Minister of Economic Development requested that another committee be added, to look at the human environment.

The Alberta Oil Sands Environmental Research Program (AOSERP) was initiated in April 1975 with a five-year joint funding agreement ($4 million each year), renewable for a further five years. A program director and staff were hired to co-ordinate and administer program activities, but they had no authority to plan and manage the program. Actual management was carried out by eight technical committees (aquatic fauna, hydrogeology, hydrology, land use, meteorology, terrestrial fauna, vegetation, and human environment). Members of the biophysical committees were staff of Fisheries and Environment Canada, Alberta Environment and Alberta Energy and Natural Resources. The human environment committee represented several Alberta government departments (identified in the next section). A representative of industry sat on each committee. The program tried to meet the diverse needs of federal and provincial interests. While industry was invited to participate on committees, it was not a partner in the agreement.

Each committee was assisted by a research co-ordinator. The committees developed the research priorities, established research projects, and managed them; most were carried out by government departments. This approach, together with the lack of authority of the program director, meant the program structure followed the principles of bottom-up management.

In 1977, the agreement was revised to reflect several organizational changes. A new program director took over and centralized management of the program. The committees were disbanded, except for human environment, and replaced by four systems: terrestrial, aquatic, atmospheric, and human. Several research co-ordinators were made research managers for the systems, with temporary positions under Alberta Environment. Scientific advisory committees, representing various interests from government, industry, and universities, assisted the research managers in developing and reviewing projects.

Organizational arrangements were changed chiefly because the academic and consulting communities had publicly expressed concern that few contracts were going to them; and the scientists were dissatisfied because the program director was not a peer, that is, he was a management consultant but lacked a Ph.D. in a scientific discipline.

A year later, in 1978, the federal government announced that Environment Canada would withdraw from the program because of financial restraints. In response, steps were taken to integrate the program into Alberta Environment, to assure continued funding and make the staff positions permanent.

The next year, Environment Canada officially withdrew. Alberta Environment continued to fund the program at the $2 million level, on a year-to-year basis.

In 1980, the program was integrated with the Research Secretariat, a line division in Alberta Environment, to form the

Research Management Division. As a result, the research focus shifted entirely to departmental interests. A new director became responsible for the program; research activities became interrelated with other research activities in the department. The request for permanent funding and positions continued.

The integration process during the period 1978-80 created considerable conflict between staff in the program and the Research Secretariat. All senior research staff who were in the program left for other jobs. This situation is not unusual and is consistent with the literature on mergers and acquisitions.

In 1981, the division director resigned and a new director began work six months later. Uncertainty about the future developed with the onset of the recession in 1981, as the political priority for oil sands research decreased.

In 1983, a change in directors occurred again.

In 1985, the provincial government extended funding for oil sands research until 1988; positions which had not been eliminated since 1980 were also extended to 1988.

HISTORY OF THE HUMAN SYSTEM COMMITTEE

Membership in the human system committee represented diverse interests, such as the Alberta departments of Economic Development (Northern Development Branch), Social Services and Community Health, Recreation and Parks, Environment, and Municipal Affairs, the Alberta Northeast Commissioner, the Town of Fort McMurray, and the Oil Sands Environmental Study Group (OSESG, representing industry). Thus, socio-economic interests came into the program, but from outside the main natural environment interests of the originating agencies. The federal government was excluded from this committee, as human issues were considered to be solely under provincial jurisdiction.

Initially the human system committee was in control of its research program, but in 1977 control passed to program management, with the research co-ordinator becoming the research manager for the human system. The committee membership remained unchanged in contrast to committees in other systems, whose membership changed considerably. The committee tried to respond to the diverse needs of the represented departments and agencies. The chairman was someone from a government department or agency, and there were four chairmen from 1975 to 1980.

In 1980, the entire human system program was reassessed in light of the changing approach to research within Alberta Environment. An effort was made to complete any unfinished projects and the advisory committee was disbanded. By the end of 1981, human system research had terminated.

MANAGEMENT CONTEXT

Complexity and Uncertainty

The description above attests to the high levels of complexity and uncertainty of the human system and the program as a whole.

THE MONITORING APPROACH

Scope

Because of its diverse membership, the human system committee attempted to satisfy a variety of research needs ranging from history, studies of social services delivery, to the more esoteric area of environmental perception.

During the period 1977-80, an administrative framework was developed to categorize the projects: exploratory studies; field studies; a conceptual framework study; and a compendium of economic, demographic and social statistics. Brief descriptions of these will be given in the next section.

Integration with the biophysical: The main focus of human system research and monitoring was on social systems. Three projects were, however, related to human-natural environment interactions: environmental health, which was never completed (Dennis 1979); perception of the natural environment (Marino *et al.* 1980); and the leisure delivery system (MTB Consultants Ltd. 1980). There was little, if any, relationship between these projects and biophysical research. None of these projects involved scientists from other systems, nor did the scientists exhibit an interest in them. Other potential linkages in resource (animal) harvesting, or domestic water consumption, being researched in other systems, were of little interest to the human system.

Collection and Analysis

Various attempts at conceptualizing issues were made, but none seemed to satisfy the highly diverse needs of the committee and/or system management. Some projects were not completed. The results of others were available in limited circulation, after peer review. Many were published as program reports. The four categories of projects are described below.

Exploratory studies were those undertaken from 1975-79 to review and analyse existing information or to develop potential research models. Four were oriented toward impact assessment and monitoring. An early study assessed the feasibility of a social indicators research model (Snider 1979). The final report suggested that ". . . social indicators appear to have more policy relevance and implications than other groupings of social statistics." Program management did not continue with this approach on the assumption that there was data incomparability and difficulty in applying the methodologies. Another study set out to identify the significant social problems in the oil sands, and the preventive and rehabilitative measures to be taken. The project proposed a 10-year research program to follow the identified problems (Van Dyke 1977). It was not implemented. The relationship between rapid resource development and family/individual adjustment to changing social conditions was examined in a literature review. From this, a theoretical model and research design was proposed (Larson 1979). The design was not implemented. The fourth project was initiated to develop a research design for a longitudinal study of personal adjustment and social conditions in the oil sands (Berger 1980). This project was the basis for an actual field study, mentioned below.

Field studies fell into five sectors:

- the oral and socio-economic history of the region;
- economic overview and service delivery systems;
- social impact research on human adjustment in Fort McMurray;
- labour studies; and
- environmental perceptions, environmental health, and recreation and cultural service delivery; these projects examined the relationships between people and the natural environment.

The relationship and interfaces between economic growth and changes in social and personal conditions were studied. This project was also intended to suggest techniques for forecasting future impacts on the local economy (Nichols 1979). Another project surveyed 430 local residents to measure aspects of social and personal adjustment to living in Fort McMurray (Gartrell *et al.* 1980). This was to be followed up in 1982, but human system research had terminated by then. A study on human health was to identify indicators to monitor (Dennis 1979). The objective was to identify conditions relative to human health, medical parameters to measure, and to do a preliminary assessment of human health conditions. The project was never completed. Finally, a recreation and cultural services delivery project was expected to help forecast future trends in demand for these services (MTB Consultants Ltd. 1980).

Conceptual framework and compendium studies arose out of the objectives established in 1977, and the inability to implement any models or research thrusts from previous projects. They were developed specifically for monitoring and prediction, as the vehicle to integrate diverse research projects, and were a major attempt to provide relevant policy and decision-making information for government departments. The conceptual framework identified data needs relevant to economic, demographic and social characteristics of the region (Harvey 1980). It was based on a survey of government agencies and oil companies and identified 10 indicator areas for policy planning: population, employment and labour force, housing, education, health, counselling and welfare services, culture and recreation, protection services, criminal justice, municipal administration and physical services, and regional infrastructure. The compendium of statistics was developed from the framework (Harvey 1980). An objective of the compendium study was to define methods for monitoring statistical data to determine the changes arising from future resource development activities. Data from 1961-79 were compiled in the first phase of the compendium study (Harvey 1980), but specific methodologies for collecting new data were never explored.

Initially, the compendium study was to develop econometric projections for various phases of oil sands plant construction, i.e., a "Target Tracking" approach. This, however, ". . . was abandoned because socio-economic conditions in resource development regions are subject to many intervening variables rooted in political decisions" (Kasinska 1981:226). It was left to the compendium study ". . . to define methods for monitoring of statistical data to determine the changes arising from future resource development activities " (Kasinska 1981:226). Evidence did not exist to show the indicators demonstrated causal relations between aspects of development and outcomes. The ability to predict from certain data, just because an agency considered the information was relevant to policy, was not established.

Work on the framework and compendium studies was terminated in 1980, following an independent assessment by consultants.

In short, the original orientation was "Information Sponge" using a variety of quantitative and qualitative methods. The compendium appears to be a more focused version of the "Information Sponge" approach. There seemed to be no way of satisfying the dual demand for simplicity and complexity.

The monitoring program faced a number of practical problems. First, there was a lack of any clear direction on what to monitor, until the final conceptual framework was developed. As Kasinska (1981:216) notes, without a firmly established theoretical basis for a conceptual model, the main problem was ". . . that nearly every kind of information could be considered relevant to the analysis of effects of resource development . . .." Second, the final framework was only one of several which were tried, but which were never used for several reasons (e.g., they were unacceptable to the committee or research manager, suffered from a lack of data sources or were too academic). Third, the diverse interests of committee members created a major problem — what might satisfy one agency would not be useful for another. Fourth, the rapid change in the oil sands meant it was difficult to identify what would be important. Finally, the SIA field itself was in considerable flux and only then developing other monitoring programs for boom conditions. Thus the SIA community could provide little guidance at the time.

Interpretation

With the difficulties and diversity described above, interpretation of change and its significance were not possible.

Feedback

Many reports were made available as public documents. Seminars were held, and consultants and researchers gave project overviews and summaries of results to interested parties in government, industry and academia.

MANAGING THE PROCESS

Process of Analysis

Human system program development and project management followed a standardized, scientific approach. Ideas were solicited from all committee members, priorities selected and terms of reference developed. The contracting process was similar to that of biophysical systems, always ending in peer review prior to publication. However, the diverse nature of the

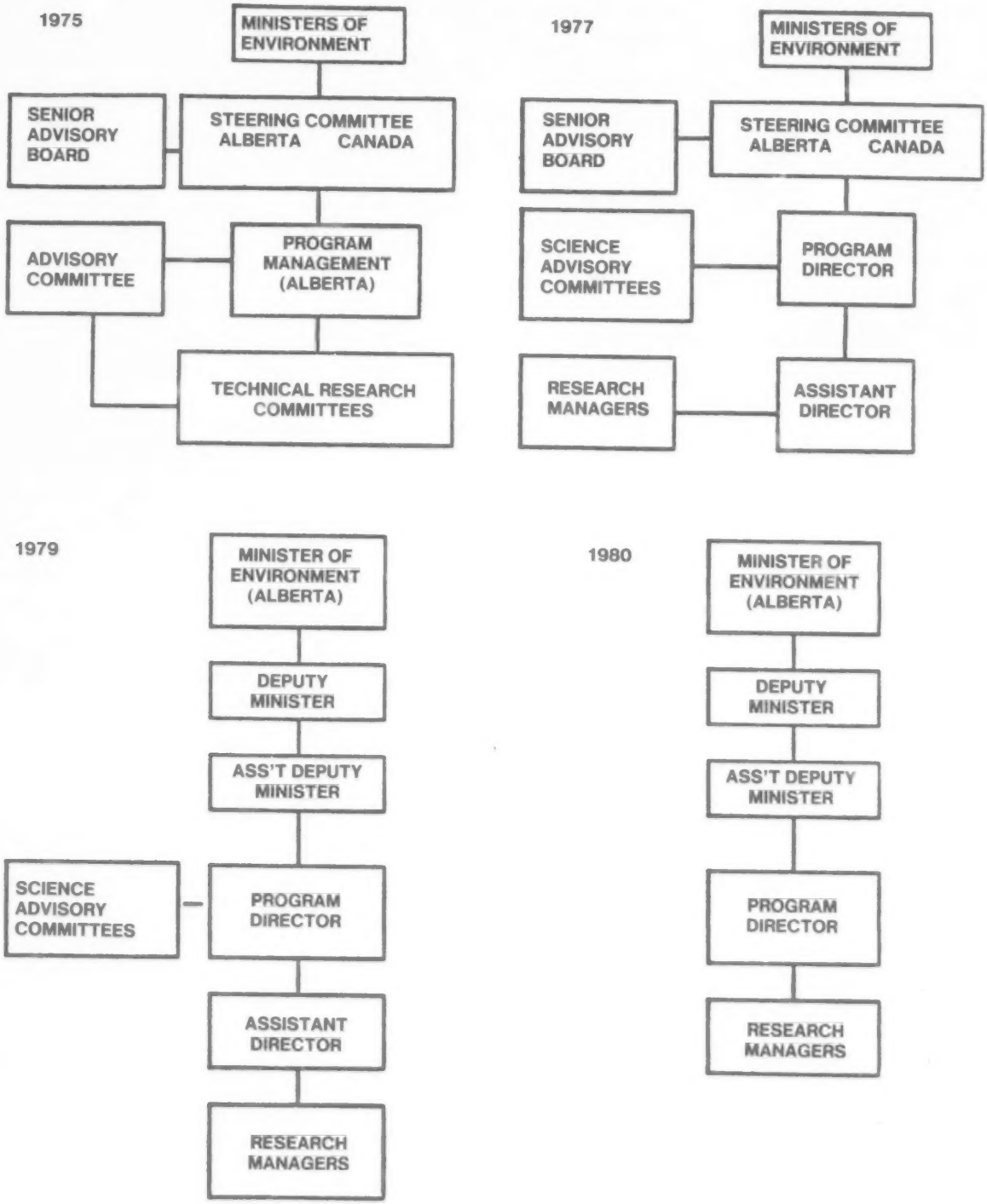

Figure A-3. AOSERP Organizational Relationships

committee, with each member interested in using the funds to further the objectives of his/her particular agency, resulted in a conflict-ridden, turbulent decision process. Process elements are described in the section "Process Management," below.

Organizational Arrangement

Between 1975 and 1980 there were four structural changes in the program. These are outlined in Figure A-3. Each change also affected the human system committee.

Process Management Issues

INCLUSION OF THE PARTIES-AT-INTEREST

The several parties-at-interest in human system research were:

- AOSERP Program Management,
- the Human System Scientific Advisory Committee,
- Alberta Environment,
- industry,
- the Fort McMurray community,
- native communities in the region, and
- academic researchers and consultants.

AOSERP program management was responsible for developing the program, its administration, and accounting for its funds. Staff positions were temporary within Alberta Environment. Staff in the biophysical systems had little interest in or understanding of human system research (and vice versa).

The Human System Scientific Advisory Committee (the official title of the human system committee) represented diverse agencies, whose needs varied and included planning, service delivery, and research. These agencies saw a large pool of money available to support their interests (by 1979, about $250,000 was being spent on impact assessment research, making it the largest social impact research program in Canada).

Alberta Environment had different levels of interest in the program but relatively restricted interest in the human system. The major interest in the human system came from the Public Participation Branch of the Environmental Assessment Division. One project briefly involved members of the Research Secretariat. That division did not have its own human system staff member until 1979, which accounts for its lack of involvement. In 1978, staff in the program and the Research Secretariat began planning to integrate the two divisions. This brought the two groups into close contact during that time.

Industry was associated with the human system committee through the Oil Sands Environmental Study Group. Although industry did not fund any projects, this mechanism allowed better communication with operating companies and access to data as required.

The Fort McMurray community was represented on the committee but served largely as the object-of-study.

The native communities in the region were not involved in the research program, except as the objects-of-study. The Fort MacKay Band requested information and a presentation from the human system, and on that basis concluded that the program was not related to their interests (Simonetta, pers. com., 1980).

Academic researchers and consultants had a direct interest in the human system as a source of research funds, since research was not done in-house. A major emphasis was placed on hiring Alberta expertise, although several projects were contracted to out-of-province consultants.

RECEPTIVITY

Considerable interagency conflict existed within the committee, and between the committee and program management. This was never resolved satisfactorily. Each member was interested in furthering the research interests of the agency represented. Cohesion and common purpose were never achieved.

COMMITMENT

Program management had a legal agreement defining its responsibility, until 1979; after this it reported directly to Alberta Environment. As a result, program management was committed to developing research and administrative activities. About $1 million was spent on human system research, prior to its termination in 1981. Alberta Environment had little direct responsibility for or need of data produced in the human system, as the focus was on socio-economic, not environmental indicators. Thus its commitment to the human system was minimal. Once the program was integrated with the Research Secretariat, this commitment was quickly reduced and eventually terminated.

Human system committee members were committed to develop research to meet their needs. As the funds were totally from the program, this was a way for them to get additional funds outside of their own budgets. For example, in the compendium study, the indicator areas and the statistical variables within them had been selected on the advice of potential user agencies, and on their accessibility and compatability with different sources. However, the user agencies had not indicated a commitment to providing, or collecting, any data for the compendium.

Industry's commitment was restricted to providing an industrial perspective to the research needs (industry was co-funding several projects in biophysical research, but not in the human system).

ACHIEVEMENT OF OBJECTIVES

Objectives

Objectives were set for both the program and for each system. We will discuss the objectives set for the human system

research committee. In 1977, the following objectives were developed (Smith 1981:78):

1. *To review and assess the available information pertaining to the Human System of the AOSERP study area*

2. *To undertake studies which may be used to establish the baseline states for social conditions of the study area which could be altered by oil sands development*

3. *To identify and explain various direct and indirect impacts of the development on people of the region, including the relationships between changes in socio-economic and social and personal adjustment*

4. *To critically assess the relationships between people and the changing urban and natural environments of the region, including use of various resources by the population and effects of changes in the environment upon people*

5. *To derive a conceptual model which can be used to forecast the effects of oil sands development on the human systems and their capacity to absorb these effects without permanent or long lasting debilitation*

6. *To undertake studies which will identify alternative measures to rectify or prevent any negative effects of the development activities on people of the region*

Here the focus is on impact prediction, as indicated by the fifth objective, which is supported by the first four objectives; monitoring is inherent in these. The sixth objective is related to impact management.

From 1977 to 1980 the human system committee developed a new set of objectives and a research framework to support the interests of its members. The objectives were stated as (Kasinska 1981:208):

1. *establishment of baseline states of economic, demographic and social conditions so that changes in these conditions between 1961 and the present can be understood in terms of a relevant context;*

2. *identification and quantification, where possible, of changes in economic, demographic and social conditions which have been associated with Athabasca Oil Sands development;*

3. *interpretation of patterns of change in the historical, regional and community context, and assessment of their relative desirability and of implications for future developments in the study area; and*

4. *identification of alternative means which might be considered by government and oil sands industry to ameliorate any negative changes and their consequences and to enhance the positive changes associated with the development activities.*

The first three objectives require a monitoring function and relate to research for impact prediction (although not all research projects under these objectives would be oriented toward monitoring and prediction). The fourth objective relates to impact management.

Evaluating Objectives

If we combine the objectives for the human system, they relate to two areas: impact prediction monitoring and research, and impact management monitoring and research.

IMPACT PREDICTION

The human system committee did not conduct any monitoring projects, other than those which relied on historical data collection. The compendium, which was meant to become the monitoring guide for the policy indicators, was cancelled following critical evaluation by four external advisors, two of whom were experienced in SIA. The 1979 survey of the personal adjustment of oil sands residents, which was to be repeated in 1982, was cancelled because it was not related to Alberta Environment's mandate (D. Stokes, pers. com., October 1985). As a result, human system research never reached a stage where it could have predicted impact, nor did it have a capability to do prediction management research. Under ideal conditions it would have taken several years of data collection before predictions could be made.

IMPACT MANAGEMENT

Impact management research was never carried out, and this objective was not achieved. We believe impact management was seen as following directly from prediction research, however, our monitoring framework shows the two are separate. The objective would have been achieved if any alternative means to ameliorate negative changes and their consequences were identified through research.

Our analysis has shown that a research framework was developed, but neither impact prediction research nor impact management research was ever conducted. We do not believe that the two objectives were achievable, given the conditions which existed at the time, for the following reasons:

- The situation was too dynamic. The "boom" conditions at the time created an extremely complex and uncertain situation.

- Suitable scientific expertise was not available to the program. The state of the SIA field provided little by way of well-developed methodologies to use under such conditions, and the necessary expertise was lacking in Canada.

- The research framework tried to satisfy too many requirements. The lack of clear direction for a research program and the attempt to "be all things to all people" diverted energy and dollars in various directions that could not build on each other. The human system committee represented diverse constituencies that could not be successfully integrated within a single monitoring program.

- Commitment and support was not provided by agencies involved. The interpersonal dynamics of the committee members, AOSERP management and Alberta Environment

personnel created a conflict situation that was not resolved. The proposed research direction and data collection system, the compendium, was not directly related to Alberta Environment's mandate, so the department had no reason to fund it over the long term. The other government departments and agencies were not committed to collecting or providing relevant data for the compendium, nor to funding the project.

- The theoretical basis for prediction was not established. The expectation in AOSERP that conceptual models could be developed for impact prediction (in both the biophysical and human systems) was overly optimistic. While the human system framework tried to encompass many variables, biophysical monitoring research was narrowly focused. Eleven years later even in the biophysical systems, predictions are not being made.

COMPARISON OF HUMAN SYSTEM RESEARCH WITH THAT IN THE BIOPHYSICAL SYSTEMS

To properly evaluate the success of the human system in developing a prediction monitoring program, it is important to compare it with progress in the terrestrial, aquatic and atmospheric systems during the same time. What follows is a brief analysis of the situation, based on reports and interviews with present research managers. It is not a detailed evaluation of AOSERP. Most of the analysis focuses on the period 1975-1981, when the human system still existed.

Each biophysical system operated independently of the others. Monitoring projects focused narrowly on specific environmental system components, using standard techniques such as chemical analysis of sulphur and its compounds in soils, an analysis of sulphur isotopes in vegetation, pH and chemicals in relation to water quality, pollutant transport and transformation in air. No attempt was made to develop elaborate models within systems or across system boundaries.

Exploratory work on biomonitoring began during the first five years. For example, chemical and microbial characteristics of the Athabasca River were studied to develop a biochemical model, and individual plant responses to atmospheric emissions were also monitored. Ecosystem effects biomonitoring did not begin until about 1981.

In 1977, each biophysical system set an objective to develop a conceptual and/or mathematical model to predict effects within that system. By 1980, no system had met this objective. In 1985, scientists in the aquatic and terrestial systems were reassessing the approaches to monitoring developed over the previous 10 years (B. Hammond and P. Sims, pers. com., October 1985). Conceptual models have not been developed, nor has research advanced to a level such that effects of development on the ecosystem can be predicted.

In his summary report of AOSERP, Smith (1981) noted several deficiencies in the four systems. He recommended that future research be planned on an integrated inter-system basis, and that monitoring systems be further developed. Only one project since then has examined inter-system linkages (at the air-vegetation interface).

Although human system research terminated in 1981, biophysical research has continued. Both the terrestrial and aquatic systems have now revised their approaches to monitoring, on the basis of what has been learned during the previous 10 years.

Twice during the period 1975-1980, program management attempted to develop linkages between the systems. An early study developed a conceptual framework for a program information system (Harnden 1976). The suggested approach was never implemented (the reasons for this have not been documented). In 1979 and 1980 a series of workshops, based on computer simulation modelling (see Holling (1978) for the basis of this approach), tried to interrelate data from the four systems, and to develop a model to guide future research. The proposed model and simulation modelling encountered great difficulty in dealing with the human system data. The model has not been used in any future research development, because the research managers did not see its benefit to their programs. (See Chapter 6, the section on linkages, for a more detailed discussion of the modelling exercise.)

APPENDIX B

BIOPHYSICAL MONITORING AND RELATED ISSUES

INTRODUCTION

The primary focus of our study is the SIA monitoring framework that we have developed. SIA is a component of the EIA process, although each has tended to be seen as separate from the other. As a result of the natural disciplinary divisions which exist within the scientific community, the EIA process has consisted of two camps, social and biophysical, resulting in the general lack of integration or linkage between the two. In this Appendix we explore current issues in the biophysical systems, as background to our main discussion on linkages in Chapter 6.

In examining the issue of linkages in monitoring we reviewed literature, attended conferences (such as the Follow-up/Audit of Environmental Assessments Conference, October 1985, in Banff) and interviewed practitioners. Information developed at some previous conferences or workshops has been useful. Three specific examples are: Environmental Monitoring of Federal and Provincial Projects (Ottawa, 1982); Symposium on Environmental Monitoring (Edmonton, 1982); Workshop on Research and Development Related to Oil Sands, Heavy Oil, and the Environment (Calgary, 1985).

In all these cases, monitoring and its relationship to impact assessment was discussed. For example, at the Workshop on Research and Development Related to Oil Sands, Heavy Oil, and the Environment, three issues out of the five identified by workshop participants were related to our needs. These issues were lack of co-ordination between agencies, lack of public involvement, and lack of information on human health and social effects. Participants suggested that responsibility for monitoring and evaluating impacts in the oil sands has not been clearly defined, because the federal and provincial governments and industry have not clarified their mandates. Also, effective public participation is lacking because of mistrust and misunderstanding between the public, industry, and governments. At this workshop, the Chairman of the Energy Resources Conservation Board of Alberta called for more involvement of local people in monitoring programs (Millard 1985).

The interest in linkages is one issue out of many that have developed as the EIA field has evolved. The present state of development in the field is summed up by Munro *et al.* (1986:32). "Whatever the causes, Canadian concerns with the environmental implications of development seem to have shifted from almost exclusive emphasis on specific environmental impacts to the more mature realm (as policy issues go) of management, of improving institutions, standardizing procedures and achieving efficiency and cost-effectiveness."

Thus we are moving out of the realm of strict scientific enquiry, long the domain of the scientist, and into a heterogeneous environment involving scientists, practitioners, bureaucrats, and publics, often representing disciplines (and paradigms) and interests that have not traditionally been part of the EIA process. To examine linkages, then, a necessary first step is to understand some of the dominant issues in the field. We take the first step in this Appendix. However, a more thorough analysis requires further research.

CURRENT ISSUES CONCERNING ENVIRONMENTAL IMPACT ASSESSMENT (EIA)

We have identified five main topics related to the biophysical systems in EIA that need to be understood (to a greater degree than is possible in our brief analysis) if linkages are to be improved:

- monitoring in the biophysical environment,
- the state of environmental impact assessment,
- environmental audits,
- risk management, and
- public involvement.

We discuss each of these briefly.

Monitoring in the Biophysical Environment

Most of the literature on the biophysical environment focuses on the assessment process, and discusses monitoring within that context. Some literature specifically discusses the state of monitoring. Here, too, certain issues indicate that monitoring, while it is understood to be a useful tool in decision making, has not developed to the level of utility originally expected. The statement of Sors and Wiersma (1981:3-4), in their lead editorial to the new *Environmental Monitoring and Assessment Journal*, indicates that "in general, environmental monitoring has failed to live up to expectations as a tool of environmental management. . . . perhaps the most important reason is that the difficulties of designing and operating meaningful monitoring programs . . . have only recently become apparent."

Within the ecological framework, Beanlands and Duinker (1983) identify monitoring as a critical component of the assessment process, for two purposes: to test impact predictions and hypotheses, and to test mitigative measures. They suggest that monitoring, however, has not been a well-managed and successful activity. Industrial proponents usually monitor only when required by permit, in case of possible

future compensation claims, to facilitate project approval, or to argue against over-regulation. (The environmental manager for one of our case studies indicated that senior management would only support monitoring for prediction if it showed that such monitoring studies would not have to be done in the future.) Beanlands and Duinker offer two general conclusions from the lack of follow-up monitoring and research programs: companies are generally unwilling to spend money and time after the impact statement is submitted; and regulatory agencies do not require such studies.

Beanlands and Duinker suggest that monitoring is widely recognized to be important in EIA. In their review of over 30 EIAs, however, they found that descriptions of proposed monitoring programs ranged from platitudinous statements to those containing specific details. (While the authors did not try to examine the monitoring programs in their case studies, the audits reviewed by Munro *et al.* discussed below in the section on audits, indicate what has been found in other analyses.) Beanlands and Duinker strongly recommend that monitoring become a higher priority than is now evident in the EIA process.

Munro *et al.* (1986) indicate that monitoring in many cases has not been undertaken because no regulatory authority has required follow-up of projects, or required evidence from previous studies in assessments. Such requirements are seen as improving monitoring because of the attention they would focus on projects after the assessment process. In our literature analysis of the S/A framework for monitoring, we have discussed monitoring definitions and the implications for monitoring programs (see especially Krawetz 1981c, and Carley 1984a). Some of the literature examining monitoring in the biophysical environment does examine monitoring definitions, but the definitions, and the words used interchangeably with monitoring, are not universially accepted. Nor do practitioners necessarily understand the different dimensions of monitoring that have implications for the conduct of programs (as suggested by Carley and Krawetz). Again, these monitoring dimensions need to be examined in more detail, to ensure that linkages with the socio-economic systems are of a similar kind. Three references indicate the situation.

Harvey (1981,1982) has reviewed monitoring within the environmental context and gives a detailed account of its proposed meanings during the 1970s. He suggests that monitoring may have two distinct functions, descriptive and regulatory, which define the purpose of the monitoring activity. The differences between the two can be considered if descriptive monitoring is related to baseline determinations and research, while regulatory monitoring is seen to serve a control purpose. Each function also may be divided into different types.

Descriptive monitoring consists of source monitoring (emissions), ambient monitoring (the pollutant within an environmental sector or medium of dispersal), and effects monitoring (the effect of the pollutant on the receptors).

Regulatory monitoring consists of four basic types: monitoring by a polluter against in-house standards, monitoring by a polluter against external standards, law-enforcement monitoring by government agencies, and policy-assessment monitoring by government or independent agencies examining the success of environmental policies.

Conover (1985) presents two definitions: *environmental monitoring* is repetitive data gathering, data analysis and interpretation, and data presentation to observe, record, or test the operation of an environmental factor for the purposes of complying, warning, determining the status of, or evaluating predictions, performance, or evidence of change. *Environmental effects monitoring* measures changes in environmental factors to establish cause-and-effect relationships between a natural or human-generated environmental factor and affected environmental components. The objectives may be to determine consequences, to test impact predictions and hypotheses, to test performance and/or mitigative measures, to improve design and performance of future similar projects, and to help ensure the wise stewardship and well-being of the environment.

Conover also identifies several types of environmental monitoring. Inspection, surveillance, and compliance monitoring relate to complying with expected performance. Environmental audits are a systematic and comprehensive examination of project performance in satisfying environmental goals and objectives. Status and trends monitoring assess and document the status and long-term changes in environmental variables.

Ausmus (1982) identifies three types of monitoring in biophysical systems. *Contaminant monitoring* looks at contaminant concentrations in effluents and emissions. *Biological effects monitoring* looks at uptake or physiological responses in a species. *Ecological effects monitoring* concentrates on the net response of biotic-abiotic interactions as a function of pollutant inputs.

Each of these "levels" of monitoring provides different information about the environment; contaminant monitoring is the most common type in use.

The difficulty with definitions is an issue, although probably not seen as such by scientists and practitioners. The above references indicate a variety of interpretations/definitions and Munro *et al.* (1986) suggest others. The problem is compounded when new interests enter the field, as is happening with the move to auditing EIAs. Several definitions of auditing were proposed at the Follow-up/Audit of Environmental Assessments Conference in Banff, October 1985, and others are discussed by Munro *et al.* We also found that research managers we interviewed in the course of the study did not tend to distinguish between different types of monitoring, or to associate objectives, and the implications of these objectives, for impact management or prediction, with monitoring. To many practitioners and scientists, it may be a case of "monitoring is monitoring is monitoring."

What is missing from this review, and in particular from these references, is a discussion of monitoring when pollutants are not involved. Conover's definitions are broad enough to cover issues such as impacts of a resource development on animal harvesting, but both Harvey and Ausmus concentrate on

pollutants. Other examples could be identified. Monitoring for human health is another major area not discussed here. We believe this to be a particularly important linkage issue, but human health is frequently not a consideration in impact assessments, and health effects monitoring tends to be in a separate category (Somers 1982), much like the biophysical and socio-economic categories.

Although an exhaustive literature search has not been done, these findings suggest some common ground should be developed, such as an acceptable model of monitoring. This would provide a common understanding for those developing monitoring programs, not only for the biophysical environment, but also when communication between the biophysical and social scientists is critical to integrated activities.

The State of Environmental Impact Assessment

The impact assessment process in Canada is generally recognized as not providing the strong input into environmental decision making that was initially expected. This is only natural in a new and rapidly evolving field. We see evidence of the search for improvement in several areas.

The major work by Beanlands and Duinker (1983) focused on improving the process by moving to a more scientific, ecological approach. They provide valuable insights into the current situation. In the course of their work they reviewed over 30 EIAs. They found the assessments generally lacked a recognizable design within which ecological relationships could be studied. Predictions in the EIAs were commonly vague and of questionable value to decision making.

Beanlands and Duinker identify several issues that are relevant to the approach taken for our project. They found little evidence that lessons learned from past impact assessments and programs were transferred to other assessments. Frustrations in the scientific and impact assessment community are evident from a lack of a common perception of the purpose of doing an assessment, because the EIA process is not designed for the longer term ongoing activities, and because information transfer from the scientific community to practitioners is poor. In addition, interviewees in their case studies suggested that the limitations to applying ecological concepts appeared to be related to the attitudes and perceptions of persons involved, and to the administrative and institutional forces at work (Beanlands and Duinker 1983:117).

Dorcey and Martin's analysis is another example of the approach now being taken by several authors in examining the assessment process. Like Beanlands and Duinker, Dorcey and Martin analyse the organizational and behavioral issues, in addition to technical matters. We suggest that this approach is directly related to our own, and helps to understand what will be encountered in forging links. Dorcey and Martin indicate that "some of the critical difficulties that were encountered [in the case studies] have not been given adequate attention in the IAMM [impact assessment, monitoring and management] literature, in particular the skills that people bring to these processes and the interdependence of skills and process design in determining success" (Dorcey and Martin 1985:2).

The two cases analysed by these authors involved mine tailings disposal into coastal inlets of British Columbia. During the 15-year period studied, a number of social and scientific issues were encountered in the projects, and these resulted in several approaches to their resolution. In addition to the normal substantive scientific issues dealing with biophysical problems, five issues concerning the practice of science were identified: 1) determining relevant scientific questions; 2) appropriate methodologies; 3) interpretation of data; 4) data presentation and reports; and 5) reviewing the results of investigations and monitoring. "These scientific issues were entwined in the social issues which provided their context; participants' attitudes to the social issues strongly influenced the perceived significance of the scientific issues" (Dorcey and Martin 1985:5).

Issue resolution became a main factor in these cases. The authors suggest that by identifying an issue as "routine," "difficult" or "impossible," it is then possible to develop various ways to work towards a resolution. In these cases, processes consisted of referrals from one agency to another, meetings, and the formation of special purpose groups. The success of these processes varied. The authors came to two major conclusions. First, interpersonal and group skills were critical to the cost-effectiveness of each process. Second, that success depended on issues being routed into an appropriate type of process, and again the interpersonal and group skills of individuals were important to achieving this routing. Individuals need to be able to work in an environment which draws on their process skills and on their ability to successfully relate to issues in several disciplines. "The conspicuous weakness is in the continuing scarcity of individuals with trans-disciplinary skills that integrate the natural and social sciences" (Dorcey and Martin 1985:23).

Environmental Audits

Environmental audits have recently been developed with the intention of improving impact assessments, and as a check on the accuracy of predictions. The 1985 Follow-up/Audit of Environmental Assessments Results Conference focused on the four topics of impact prediction, monitoring and mitigation, public involvement, and management procedures; but the theme of the conference was decidedly oriented to biophysical assessments. Although social factors were to be considered, the conference brochure indicated that "social factors are to be limited to ones which are linked in a direct way to biophysical impacts." Several papers from this conference are referenced in our report. In this section we will identify several issues reported by Munro *et al.* (1986), in a review of the literature and of 10 audits commissioned by Environment Canada and presented at the conference.

Munro *et al.* suggest auditing is being promoted because of numerous examples of poor environmental results, little previous study of predictive accuracy, and a rapidly changing field of knowledge. They point out that a completely bounded social or ecological system does not exist, over an extended time frame, thus it is unreasonable to expect detailed accuracy from assessments. There is also an indication that hypotheses can be quite precise in physical sciences, and that while environmental sciences are becoming more precise, the social

sciences have not yet achieved such precision. "Physical scientists are used to a form of investigation which is based on clearly stated hypotheses and requires precise data to reach conclusions. Many social scientists have found that attempting similar precision may lead to absurdities. The level of present knowledge about the causes of human behaviour is such that social scientists often find themselves unable to achieve numerical precision when analysing broad changes. . . . Environmental science may be in much the same situation" (Munro *et al.* 1988:29). The implication is that predictions of social impacts are unlikely to be useful or accurate. Munro *et al.* do not provide any information to support this statement, as their literature review and audit case studies do not examine the social or socio-economic aspects of assessments (see Culhane, below).

Munro *et al.* suggest that there appear to be major problems in the assessment-design-implementation process, not in the scientific technology available. This is illustrated in the kinds of questions raised in their review.

- To what extent can a co-operative model of assessment replace the adversarial one?
- Can working groups at the technical level solve problems which would be intractable at the policy level?
- What type of policy process best enhances the establishment of mutual trust on the part of participants from different organizations and with different knowledge bases?
- Is there any consistent guide to avoiding controversy over environmental impacts?
- Once controversies arise, what is the best way to manage them?

These issues fall into three main areas: human relations in the assessment process, issue management strategies, and constructive institutional roles. The issues also indicate current problems may be more sociopolitical than scientific.

In his review of environmental follow-up to federal projects in Canada, McCallum (1985) identified several factors which contributed to the ease and effectiveness of follow-up, those of relevance here being:

- agencies having positive attitudes to assessment,
- communication between all main actors,
- agencies having credibility,
- co-operation between advisory and regulatory agencies,
- a well-understood set of responsibilities,
- continuity of staff,
- issues identified and resolved in an atmosphere of unforced negotiation and co-operation.

No consistent programs or procedures for a comprehensive approach to follow-up were found in McCallum's study.

These analyses suggest that the issues concerning impact assessment are not restricted to questions of technology and scientific methodology. More and more the assessment community recognizes that the process, and sociopolitical issues related to it, are important factors. Again, monitoring linkages will have to exist in this context.

Predictions are an integral part of any assessment, yet until recently the accuracy of predictions did not seem to be an issue. Concern with accuracy has surfaced, however, with the interest in audits, mainly because monitoring programs were not instituted to track projects, or because results were mixed when predictions were compared with actual monitoring data. Only one of the 10 case audits reviewed by Munro *et al.* contained quantitative predictions. "The sense of the case studies [and of the literature] . . . is that environmental assessment techniques, if properly applied, are adequate to identify, if not precisely forecast, almost all of the major environmental implications of projects. . . . The most noticeable characteristic of environmental predictions is their imprecision. . . . [which] does not mean that they are not useful" (Munro *et al.* 1986 :22). Two examples, from Canada and the United States, indicate the general situation.

One of the few available Canadian studies in which research and monitoring have been done to check assessment predictions was reported in the *Canadian Journal of Fisheries and Aquatic Sciences* in April 1984. The diversion of the Churchill River in Northern Manitoba in 1975 has been studied since then (Hecky *et al.* 1984). Southern Indian Lake, which was impounded by the diversion, was the subject of two impact assessments, one in 1970, the other in 1974-75 (as construction was proceeding). Predictions related to the physical environment, such as increased shoreline erosion, were generally qualitatively correct, but an unpredicted decrease in water temperature occurred. Biological responses above the primary trophic level were mostly not predicted or were predicted incorrectly. The most important unpredicted change was the significant decline in the quality and quantity of whitefish caught, and the increase in the mercury concentration in fish. As a result, the local fishery has required extensive compensation. Hecky points out that fishery problems should have been considered, but they were not part of the existing paradigm of reservoir impact analysis.

Culhane (1985) did a post-project audit on 239 impacts forecast in 29 U.S. environmental impact statements. Relatively few forecasts were found to be inaccurate, but only 27% of impacts were unqualifiedly close to forecasts. Many of the forecasts were vague, and less than 25% were quantified. He also found that, in general, social forecasts had the highest average accuracy, followed by biophysical forecasts; economic forecasts had the least accuracy. A major difficulty in this project was to get information: very few monitoring programs were in place, and this was most pronounced in the biophysical environment.

Risk Management

As with auditing, risk management is being examined as a possible mechanism to improve and extend aspects of the EIA process. Only one recent review paper, that by Grima *et al.*

(1986) is discussed here. As risk is a relatively new concept introduced into the environmental framework, undoubtedly confusion will occur about the terms used. Grima *et al.* use the term *risk management* as an overall term to include the activities of risk analysis, risk evaluation, implementation, and monitoring. Risk evaluation and risk assessment tend to be used interchangeably. Risk is defined as a judgment about the measure of probability and severity of harm to human health and the health of human ecosystems, broadly defined.

Grima *et al.* suggest that the present interest in risk is a result of increasing social and political concern over management and mismanagement of potentially hazardous systems, products, projects and technologies. These are the same issues that the EIA process was introduced for in the early 1970s. The questions being asked about inclusion of risk concepts in EIAs are similar to the expectations held out for EIA when it was introduced: Will risk assessment improve the technical basis for decision making? Will risk assessment result in better decisions?

Unlike the use of audits to review projects in retrospect, risk is a concept than can be introduced in the assessment stage to focus on and provide input to the resolution of certain issues. As not all impacts in an EIA are related to risk, these concepts will be applicable to only some types of assessment.

Risk analysis tends to be technically based, using statistical procedures. We recognize that technical or scientific methodologies are critical to monitoring issues, and their availability or appropriateness will be a factor in linking social and biophysical monitoring, if risk concepts are incorporated in EIAs. But the process of risk management is much broader than a technical analysis, and the non-technical issues explored by Grima *et al.* will be important in creating effective links. Two of these issues are uncertainty and public involvement. Uncertainty is discussed in this section, and public involvement in the next.

Uncertainty is a common component of environmental assessment. It relates to the future impacts of projects. Considerable effort goes into predictions in EIA, although as previous discussion in this Appendix has shown, predicting the future is not a certain science. As Grima *et al.* point out, uncertainty as perceived by laymen and uncertainty as perceived by scientists need to be reconciled in the EIA process. At issue here is how to reconcile what are often considerable differences between the two groups. A range of scientific uncertainty (irrespective of public considerations) exists around different environmental issues, and this adds to the confusion; it is not as if the scientists agree among themselves, or that all issues have the same certainty.

We can relate this to Dorcey and Martin's (1985) classification of issues as "routine," "difficult," and "impossible" in their case analysis of tailings disposal. Although they did not put the issues in terms of risk, certainly the question of impacts of tailings disposal into coastal waters implies certain risks for the biota in the waters, and the lifestyle of the population harvesting commercial or recreational species from those waters. Dorcey and Martin's account of the complexities of issues resolution, and the processes tried, is indicative of what Grima *et al.* state is a problem needing attention. (Uncertainty will be an issue in scoping, the initial process recommended by Beanlands and Duinker. They did not examine how scoping should be done, but the analysis of Grima *et al.* and the discussion in this report indicate that it will be a complicated exercise.)

Risk issues certainly are common in Canada. Two Canadian examples are spruce budworm spraying in eastern Canada and the disposal of hazardous wastes. In Alberta, two long-standing risk issues are the human and animal health effects of sour gas emissions, and the effects of oil sands development on the Fort MacKay Indian Band. Both have yet to be resolved.

One Alberta example, the situation near Pincher Creek in the southwestern part of the province, has existed for nearly 30 years. Two sour gas plants were built in ranching/farming country near Pincher Creek in the mid-1950s. Very soon after the plants started operation, residents began to complain about health effects that they related to the gas plant emissions or effluents. Although numerous studies, mainly on animals, plants and soils, were conducted over the years, and no scientifically evident relationship between the gas plants and health effects was found, the complaints have continued. At the present time a major ($3 million) health study is under way, the intent being to resolve the issue once and for all. However, as Edwards and Krawetz (1985) have suggested, even if this study shows no link exists between the health of residents and gas plants, the results may not be believed. Residents have related their illnesses to emissions for many years and their strongly held self-diagnostic beliefs are not necessarily changed by lack of scientific evidence.

In northeastern Alberta, the Fort MacKay Indian Band lives within 20 kilometres of two major oil sands plants. The residents of this community have been involved for many years in numerous issues related to industrial development. Many of these issues have received direct attention by industrial, governmental and university scientists, generally within the broader context of industrial development impacts on the environment, impacts which the scientists can accept as plausible. But for many years, while the native people were expressing concern about water taste and contamination (they draw water from the Athabasca River, downstream from the plants), tainted fish, changing forest habitat, or the safety of using melted snow for drinking water, these issues were not considered important to the researchers. Even in AOSERP (one of the case studies in this report) the Band was not involved in issue identification.

These two examples are mentioned only to indicate that perceptual differences are a major issue, and deserve to be considered, as recommended by Grima *et al.* (1986:24). The examples also relate to public involvement, which Grima *et al.* identify as a clear priority area. Here they raise an important point, that ". . . the term [perception of risk] carries with it the slightly pejorative view that the public has 'perceptions' which are mostly illusory and emotionally based, while scientists and other experts have a monopoly on objective reality." The

authors raise the question about how public input on issues involving risk is to be handled, and suggest that research on input processes is necessary. We believe that the public input question is still a major issue in the overall EIA process — not just related to risk — as indicated in the following examination of public involvement.

Public Involvement

Public involvement in impact assessment varies throughout Canada. The level of involvement in the formal process of each province is outlined in a report by the Canadian Council of Resource and Environment Ministers (1985). In Alberta, the Energy Resources Conservation Board is calling for more public participation. Millard (1985) suggests that local people be involved in the design of monitoring programs, and that communication between project operators, local people, and the government needs to be increased. In addition, he suggests that the present regulatory process should be redesigned to assist the various parties in negotiations and in resolving problems. (Any change in the role of the public will only come about if those organizations responsible for public involvement change: individual belief systems and organizational structures may have to change (Goldenberg 1984). The Keephills case study is one example where this has occurred.) This acceptance of increased involvement is not universal, however, as evidenced by the British Columbia situation where public involvement has been restricted in recent years (Roberts 1985).

More recent experiences with public involvement in northern Canada are now being examined. Bissett and Waddell (1985) review the numerous approaches associated with the Beaufort Environmental Assessment and Review Process, which is still underway. The major concerns of the Dene, and their exclusion from biophysical monitoring programs on the Norman Wells Project have been documented (Fee-Yee Consulting 1985). (In 1982, an intergovernmental biophysical monitoring and research program was set up for the Norman Wells Pipeline. In 1984, industry and Dene representatives were added to the program committee, but Dene participation appears to be limited to training in survey and sampling techniques (Boreal Ecology Services 1985). The native population has also been excluded from the Norman Wells SIA monitoring program sponsored by Indian and Northern Affairs Canada. Although public involvement occurred in the Environmental Assessment and Review Process, the reports of the monitoring program (conducted by geographers from the University of Saskatchewan) make no mention of involvement in program design, except for providing assistance in survey interviews (Bone 1984).

Conclusion: The five major issues in EIA — monitoring, the state of the process, auditing, risk management, and public involvement — indicate the field is evolving. Each issue relates in one way or another to the potential for linking socio-economic and biophysical monitoring processes. The continued attention directed to these issues, and the greater comfort level of scientists/practitioners in their respective fields, will continue to divert attention from linkage issues.

APPENDIX C

PROJECT TERMS OF REFERENCE

The following information outlines the terms of reference provided to us by CEARC for this project. The project began in late September 1985, and was completed March 31, 1986.

PURPOSE OF THE STUDY

The purpose of the study is to evaluate the effectiveness of selected approaches to monitoring socio-economic impacts and to develop a basic analytical framework that can be widely applied for this evaluation. It is expected that the findings and product of this review will be of interest to government agencies and private companies responsible for administering and undertaking SIA studies, and to communities and groups currently and potentially affected by project developments.

The term social impact asessment encompasses:

- economic changes, such as effects of new patterns of employment and income, changes in tax-base, etc.;
- changes in use of natural resources (e.g., subsistence, employment or recreation) resulting from project development;
- changes in community infrastructural requirements; and
- changes in the economic and social organization of communities resulting from one or a combination of the effects noted above.

FRAME OF REFERENCE

The research project will encompass the following tasks:

- a review of current monitoring programs for predicting social impacts and evaluating impact management measures through a selection of two or three case studies that exemplify different approaches across Canada;
- evaluation of the effectiveness of these monitoring programs in terms of achieving the management objectives of local and provincial government, the affected communities, and the proponent (where such objectives exist and can be defined);
- the creation of an analytical framework for evaluating requirements and responsibilities for pre- and post-decision monitoring programs on the basis of the case studies;
- preparation of recommendations that will:
  - —strengthen the immediate contribution of social impact monitoring to help manage project impacts more effectively (and improve predictive analysis over the longer term),
  - —indicate centres of responsibility for implementing social impact monitoring programs, paying particular attention to the involvement of impacted communities, and
  - —suggest how social and biophysical monitoring processes might be more closely linked to produce an integrated approach to project implementation;
- definition of issues that require further research, explaining the rationale for this research and outlining the required scope of analysis.

TIMING

Phase I (the first two items of the Frame of References) will be undertaken by October 31, 1985 and reported to the Scientific Authority.

Phase II (the third and fourth items) will be completed by March 31, 1986 and reported to the Scientific Authority.

The case examples selected (Phase I) will be reviewed by the Scientific Authority prior to analysis in detail.

GENERAL CONDITIONS

- The consultant selected will be expected to finalize the plan of study, including the selection of case studies, in consultation with the Scientific Authority, and report to the Scientific Authority at key phases of the contract.
- The consultant will be expected to consult with practitioners in the field of environmental assessment in general, and social asessment in particular, during the conduct of this research.
- The consultant will review current literature on the topic.
- The consultant will conduct at least one formal consultation with a small group of SIA practitioners in a round table setting, once the results of the research (Phase II) have been drafted. The commentary derived from this workshop will be incorporated into the final draft of the report.

- The consultant, and the person contracted by the Scientific Authority to undertake a post project evaluation study, will be expected to explore points of linkage with the framework being developed on the biophysical area of environmental assessment.
- The consultant will be required to meet with persons performing related CEARC research on post-project evaluation methods through close contact with the Scientific Authority.

PRODUCT

- Phase I report
- Phase II report
- Recommendations to strengthen institutional arrangements for conducting social impact assessments in Canada
- Publications of the final report (if of sufficient quality)

CANADIAN ENVIRONMENTAL ASSESSMENT RESEARCH COUNCIL
1987

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